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05
A

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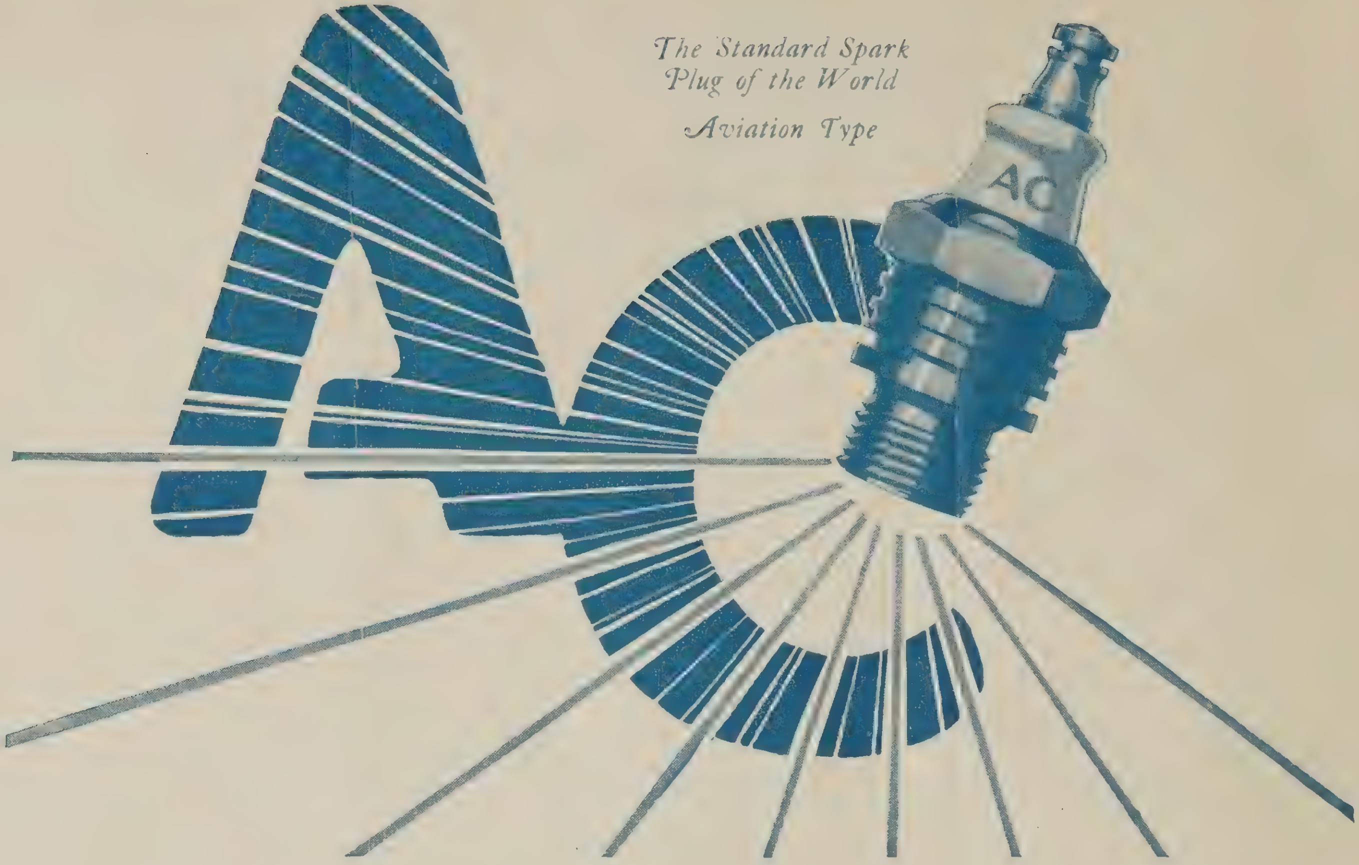
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Boring
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THE TRANSCONTINENTAL AERIAL MAIL

SEPTEMBER 8, 1920, will go down in history as the great day when the epoch-making event, the first trip of the transcontinental aerial mail took place.

When we consider that in our short lifetime we have seen human flight evolute first from a dream to a hope, then from a hope to a possibility, then from a possibility to a reality, then into a powerful deciding military factor, and now we are seeing the advent of aerial transportation and the use of aircraft to solve most difficult problems of transportation and for a hundred other utilitarian purposes, we cannot help feeling that it is a privilege to be living in such an age, and to have been a factor in bringing about these developments.

It seems but yesterday that those few of us who believed in the possibilities of human flight spent our time discussing the possibility of copying birds' wings and learning the secret of flight from the birds, those whose flight seemed easiest to study and understand, and their wings seemed easiest to reproduce in wood and canvas.

We felt heartened when Langley, Chanute, the Wrights and other pioneers tested their models and their gliders, and demonstrated the basic theories which later were the principal factors in achieving dynamic flight, likewise we felt heartened when H. G. Wells and Kipling and others expressed their belief that Man would fly some day. When Wells, in his book, "Anticipations," in 1902, stated his belief that dynamic flight would become an accomplished fact fifty years hence, the World smiled incredulously, but some of us fully believed that it would happen. We were dreamers with Wells—but very conservative dreamers, as time has proven!

The transcontinental air mail is the last proof that we were all exceedingly conservative in our prophecies!

The Transcontinental Air Mail

Postmaster General Burleson, Assistant Postmaster General Praeger and the other pioneers who have worked energetically to establish and extend the Aerial Mail Service, which was accomplished notwithstanding the most serious handicaps which had to be overcome in every direction.

Mrs. Alice Hunt Bartlett, the patriotic and energetic pioneer who so ably directed the activities of the thousands of ladies who worked to build our Air Forces and look after the welfare of the aviators during the war, has most aptly interpreted the feeling of all of us and expressed what we should like to express in the following remarkable poem which appears in the current number of *Flying,* and which lack of space prevents our quoting in full:

A rousing cheer from coast to coast resounds
To you, swift couriers, controlling flight!
Nor sun, nor rain, nor heat, nor gloom of night
Shall stay you from completion of your rounds.
To you! The big planes ride our skies each day—
Transcontinental Air Mail's here to stay!

New York to Frisco, on the Wilson-Way
At Cleveland and Chicago they will stop,
Then on to Omaha, Cheyenne—They'll hop
In hours thirty-three the U. S. A.
Through Ogden, Reno then to Frisco, Cheer
And cheer, the latest step in Progress—Here!

This land of Wrights and Langley gave the World
That greatest gift, the wond'rous gift of Wings—
There is no glory brighter, no—no King's!
Again is Progress' banner wide unfurled,
To head Civilization's march it flies
And carries Man now high thru boundless skies.

Cheer Burleson and Praeger, Pioneers—
With Woodhouse, Peary, Hawley, Post and Wood
You dared—with Hitchcock and Stewart, stood
To voice demands for Air Mail, these nine years—
With Sharp, Steenerson, Hulbert, Sheppard, too—
You prevailed with Congress—and put it thru!

Receive your Country's thanks!. You put it thru!
We thank you Jordan, Connor, Corridon
Bussler and Max Miller, Edgerton—
To Managers, Mechanics praise is due.
Then off with hats, to cheer this famous day:
Transcontinental Air Mail's here to stay!

We regret the exigencies which necessitate the omission of the eight verses of Mrs. Bartlett's historic poem which review the evolution of the transportation of mail from Cyrus's "mounted post" which was established by Cyrus of Persia in the year 599 B. C., to the first trip of the New York-Washington aerial mail, in which Mrs. Bartlett very aptly also quotes the first flights of Ovington, Beck, Witmer, Culver, Webb and Boyle. The poem closes with the following inspiring verses:

The wide world's shuttle this! Remotest lands
Unite so swiftly, woven through the air—
The frosty north, the burning sough, where'er
Man calls his brother man and understands!
And, next? across the sea's wide sweep! Air Mail!
Transcontinental! An inspiring tale!

Our longest cheers for you Airmen! Hooray!
Let's climb and bank and soar and slip and glide
Past Universes vast, on Air's great tide,
Through rosy skies well-charted, Come Away!
The Air is hard if you but hit it fast—
In Cloudland soon the Old World fades at last!

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EVIDENCE OF VICIOUS CONSPIRACY TO DESTROY AERO CLUB OF AMERICA SUBMITTED TO THE SUPREME COURT—Part IV

(*Continued from August* 30 *issue*)

THE CASE OF HOWARD E. COFFIN

Concerning the affidavit of Howard E. Coffin, sworn to July 28, 1920, and submitted in opposition to this motion, it is obvious that said Coffin in such affidavit leads us away from his relations with the defendants in the matter which caused this action and discourses on his connection with the so-called "billion dollar aircraft scandal," which is a misnomer since the war aircraft program has already cost a total of approximately one and one-half billion dollars ($1,500,000,000) and there are still a number of contracts to be settled. It is quite apparent that Mr. Coffin is still fearful of a new investigation of the so-called "aircraft scandal" and that he is supporting the defendants in this action for the reason that he has been obsessed by the members of the Manufacturers Aircraft Association with the mistaken motion that the trouble and danger of investigations being started about the million dollar government aeroplane bonfire and the conspiracy to have aeroplanes which cost over one hundred million dollars destroyed, and the irregularities and misrepresentations by which members of the Manufacturers Aircraft Association and their confederates obtained millions of dollars of government funds will be greatly minimized by the destruction and elimination of the Aero Club of America as a moral force.

Coffin Stated He Was "Double-crossed" By Associates

Deponent further states that said Mr. Coffin has been very frank with him and in their voluminous correspondence and conversations has stated to deponent repeatedly, as early as September, 1917, and as late as April 28, 1920, that he, when Chairman of the Aircraft Production Board first, and of the Aircraft Board later, had been "double-crossed" by certain of his associates who ran things "high-handed" in connection with the first billion dollar Aircraft Program and tried to oust him from the chairmanship, so as to have more power to themselves. That he had decided then, in 1917, not to say or do anything about it as he "did not want trouble."

Further, that in January and February, 1917, when deponent was requested to make a report of the aircraft situation for President Wilson and Secretary Baker, he had occasion to look into the activities of Mr. Coffin and found that he did not have a clear definition of the unwritten and written laws which govern the affairs of men, and in his fear of "getting into trouble" was apt to agree with and endorse recommendations diametrically opposed to each other; and that when the people back of each recommendation quoted his endorsements and found that he had endorsed both, they would combine in condemning him. Deponent knows that it was to some extent the confusion created by Mr. Coffin's failure to make a full and clear statement of the whole situation that caused President Wilson on February 1, 1918, to write to Secretary Baker as follows:

> **"Is there not some one entirely disconnected from aeronautics and from these who are prominent in carrying out the aeroplane program whom you can ask to go over this thing with an unbiased mind and give us his naïve impressions of it?"**

Report In Favor of Destroying Aeroplanes Which Cost $100,000,000

Again said affidavit of Howard E. Coffin is misleading in many ways. For instance, Mr. Coffin, who was stated to be in favor of burning aeroplanes which cost the U. S. Government over $100,000,000, went to Europe in the early part of 1919 with said James A. Blair, Jr., one of the defendants in this action, and the following officials of the Manufacturers Aircraft Association who were reported to deponent, by one Frank H. Russell, the president of the Manufacturers Aircraft Association, as having initiated the scheme to cause the burning of the aeroplanes for which the U. S. Government had paid over $100,000,000, to wit: George H. Houston, S. S. Bradley, General Manager of the Association and a director of the said American Flying Club; C. W. Keyes, Vice-President Curtiss Aeroplane & Motor Corporation, member of the Manufacturers Aircraft Association. In connection with their said visit to France newspaper dispatches reported the burning of a large number of American Expeditionary Forces aeroplanes which became notorious as the "million dollar aeroplane bonfire," and this said commission was reported to have authorized the burning of these aeroplanes and criticized for that and the actions of said Houston and said Bradley, who were reported to have used their membership in this official Commission, the expenses of which were paid by the U. S. Government, to coerce aircraft manufacturers of allied countries into agreements to pay royalties on unadjudicated patents controlled by the said Manufacturers Aircraft Association upon threats of litigations which they were reported as having claimed would be supported by the United States Government.

Investigations Instituted Before Coffin's Request To President Wilson

Furthermore, said affidavit creates the impression that said Mr. Coffin started the aircraft production investigation when he requested President Wilson to institute the official inquiry. Upon referring to his files said Mr. Coffin will ascertain that his telegram to President Wilson was sent from Darien, Georgia, where he was "resting" on May 4, 1918, and read as follows:

> **"The President:**
>
> **"Charges of dishonesty have been made against the Aircraft Board which demand the fullest inquiry. I request and urge that an official inquiry be had in order that the reputation of innocent men may not be ruined.**
>
> **"(Signed) HOWARD COFFIN."**

Prior to this time a number of inquiries had been instituted. In December, 1917, the U. S. Senate had adopted resolution No. 48 by which the Senate Committee on Military Affairs was empowered to hold hearings, and as a result of the evidence obtained partly at said hearings and partly by investigations conducted by other Government and civilian agencies, and because of the country wide indignation and editorial condemnation of certain conditions, the Secretary of War had, under date of April 24, or *ten days before* Mr. Coffin's request to President Wilson, appointed a new Director of Aircraft Production in place of Mr. Coffin, and on the floor of the U. S. Senate, under date of May 2, 1920, Senator King, Senator Hitchcock and other senators had denounced the Aircraft Production Board and Senator King had stated:

> **"I believe there has been not only incompetency in the Department charged with supplying aircraft but also criminal neglect, if not affirmative criminality."**

Again said Mr. Coffin in said affidavit refers to Mr. Hughes as having exonerated him in his report, and it thereby becomes necessary to point out that the scope of Mr. Hughes' investigation was limited to investigating and pursuing charges of dishonesty and malversion in regard to the production of aircraft, and to ascertain whether any section of the Criminal Code had been violated. As is clearly emphasized in such report Mr. Hughes could not deal with maladministration nor failures in judgment and purposes of the Aircraft Board and other Boards of which Mr. Coffin as the Chairman was the official and responsible head. That Mr. Coffin appreciates his responsibility is evident by the fact that on April 28, 1920, he desired to know of deponent:

> **"Do you think that the country holds me responsible for these scandals?"**

The affidavits of defendants show that they are endeavoring by misrepresentations and distortion of facts and by intrigues to convey false impressions regarding the issues presented by plaintiff and the purposes for which plaintiff seeks relief.

Manufacturers Aircraft Association Includes Only Half Dozen Out of Several Hundred Firms In Aeronautic Industry

Defendants seek to convey the impression that their actions are honorable and that they are not part of the conspiracy to make the Aero Club of America assume the liabilities of operating the American Flying Club House, which caused a deficit of upwards of $50,000 during the past year, and would

(*Continued on page* 26)

THE NEWS OF THE WEEK

Aeroplane Glides 19 Miles from 10,000 Foot Altitude

Reno, Nev.—Caught with an empty gasoline tank 10,000 feet above Washoe Lake, Daniel Davison, San Francisco and Los Angeles aviator; John Woolley, Oakland business man, and James McKay, of Reno, were forced to volplane 19 miles to the Wheeler ranch, south of Reno, recently.

Landing was made easily. The gasoline became exhausted while fighting a windstorm.

Transcontinental Aerial Contest is Postponed

Cancellation of the 1920 transcontinental air race for the Pulitzer trophy, arranged by the Aero Club of America in favor of annual closed circuit races for a perpetual Pulitzer trophy has been announced.

Word from Ralph Pulitzer, donator of the Pulitzer trophy, has been received in a letter to the Aero Club consenting to the club's suggested program. This includes a 150-mile circuit race over a twenty-five mile course at Mitchel Field, N. Y., Thanksgiving day, November 25, 1920, and a second race over a closed circuit on September 4, 1921, for a restricted class of planes, requirements to be determined by the Army, Navy and Aero clubs' contest and technical committees with a view to development of new types of sportsman-training machines.

May Hold Balloon Meet at Birmingham, Alabama

Birmingham, Ala. — Recommendations have been made by a committee of the chamber of commerce to accept the offer of the Aero Club of America to hold the annual international balloon races here. The races are scheduled for October 23. On September 23, American balloonists will compete here for the honor of representing this country. England, France, Belgium and Italy have entered teams in the finals.

Seeks Aviators for Polish Army

Lieutenant Ira S. Woodhouse, formerly of the American Air Force and now attached to the First Aero Squadron of the Polish Legion, arrived in New York recently on the Holland-America liner Noordam to recruit flyers for the army of General Wrangel.

Lieutenant Woodhouse, whose home is in Elko, Nev., has flown under four flags —French, American, British and Polish. He is looking for twenty flyers who have had experience in the war, and wished to send to Poland as quickly as possible fifteen pilots and five observers.

The Polish army has Spads and Salmson aeroplanes ready for the flyers as soon as they enter Poland. From there they will go to join Gen. Wrangel in the Crimea. Lieutenant Woodhouse has opened headquarters at the McAlpin Annex.

Baltimore Newspaper to Use Aeroplane to Gather News

The Evening Sun of Baltimore, Md., has added an aeroplane to the newsgathering equipment of its editorial department and will begin to use it immediately, with Lieut. William D. Tipton, who served for seven months on the front with 17th Aero Squadron of the American air forces.

The aeroplane has been purchased by The Evening Sun for the purpose of experimenting on the gathering of news at points difficult of acess by railroad, auto or steamer travel. Covering important happenings by means of this agency will enable The Evening Sun to report in its afternoon editions occurrences which in the past it has been impossible for this paper to report satisfactorily because of the time required to reach the spot.

This paper is the first in the country to make such use of aerial transportation. Its addition of the aeroplane to its facilities marks a new era in the gathering of news.

No other newspaper staff in the country has, up to this time, included reporters traveling by air as a regular, daily part of its work. The plane is a Canadian Curtiss biplane.

Does Shopping By Aeroplane

Shopping by aeroplane is being introduced along the North Jersey coast by Miss Peggy White, of 502 Tuttel Avenue, Spring Lake, N. J., who is summering there. She leaves her Spring Lake home every morning and motors to the De Luxe Flying Field at Como; from there she is taken by aeroplane with Lieutenant Morgan, the pilot, to the Deal Flying Field, where she motors to Asbury Park, and after the shopping expedition she returns the same way. Miss White says that when she leaves Spring Lake she is going south for the winter, and will also use the air service there for pleasurable purposes.

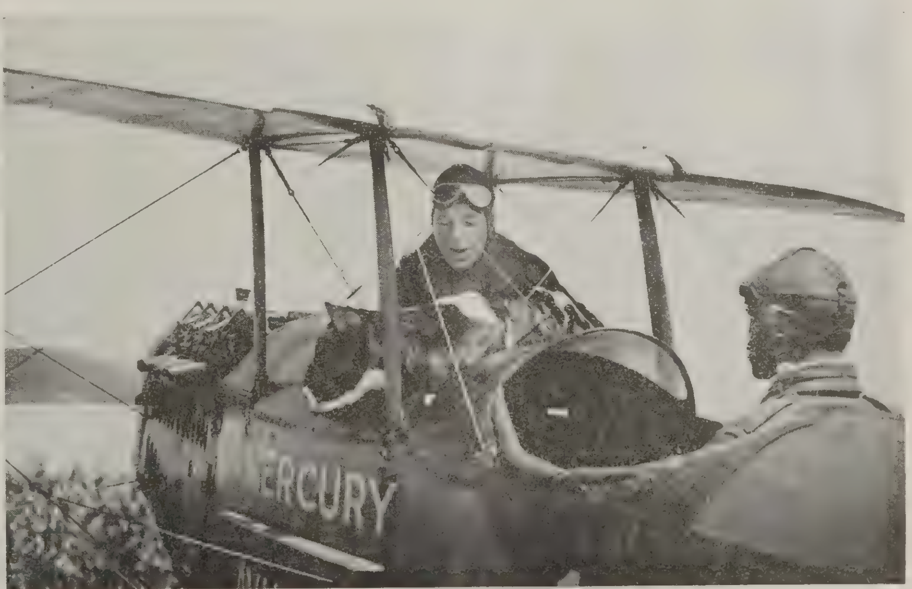
Hangar at San Diego Opposed

Secretary of War Baker and Secretary of the Navy Daniels, accompanied by Major Gen. Charles T. Menoher, chief of Air Service, and Capt. J. J. Craven, director of naval aviation, discussed the matter of the construction of a hangar for rigid dirigibles at North Island, San Diego, Calif., recently. This location had been approved by the Aeronautical Board and disapproved by the War Department. It was decided that the matter be turned over to the Aeronautical Board for further discussion and report, as the War Department declined to recede from its opposition to the erection of the immense structure at North Island, which is ground apportioned equally between the Army and Navy.

Jellico Tenn. Pioneer Mountain Town in Aviation

Through the activities of the Chamber of Commerce Jellico, Tennessee, has established one of the best Landing Fields in the South. The field itself has about 60 acres on which is erected a splendid hangar which will shelter three planes. An office is established in connection with the hangar with telephone service and electric lighting system. A repair station is being established and high test gas is always obtainable for visiting aeroplanes. Through the enterprise of the Jellico Aero Club several near by towns are purchasing planes and are establishing Landing Fields. Jellico is on a direct route from Cincinnati and Louisville to Knoxville, Chattanooga and Atlanta. The Jellico Aero Club is now planning passenger and mail service connecting these various towns. As soon as the demand for flying at various fairs is over schedule passenger flying will begin and mail transportation wil be handled in connection.

The Jellico Aero Club is under the direction of the Board of Directors with Mr. L. E. Woody President and General Manager and W. I. Jones, Secretary of the Chamber of Commerce as Sec.-Treas. Captain Walter J. Carr, Army Instructor during the war is the chief Aviator and Promoter. Captain Carr is now making plans to develop fields and place aeroplanes in most of the towns of importance within a radius of 200 miles of Jellico. Owing to the difficulties of this mountainous country it was thought impossible for aviation to succeed in the Southern Highlands but Jellico situated in the very heart of the Cumberlands has demonstrated that the Aeroplane is not only possible but highly useful in this mountainous section.



The Mercury Aviation Co. is probably the first to have a prize calf consigned as aerial freight

Banker Commutes to Summer Home in Mountains By Aeroplane

Gilbert H. Budwig, ex-civilian flying instructor at March Field, landed at said field in a plane, the property of L. C. Brand, President of the Title Guarantee & Trust Company of Los Angeles. The plane is patterned somewhat after the LePere and was built at Venice, California, under the direction of H. H. Waterman, aeronautical engineer. It is propelled by a 12-cylinder Liberty motor and has several unique features, among them an ice box.

Mr. Brand will use the plane for weekend trips between Los Angeles and his summer home in the Yosemite.

Inspect Army Records on Trip By Plane

The efficiency of the aeroplane was clearly demonstrated recently when Colonel Gaujot traveled from Douglas to Phœnix, Arizona, for the purpose of inspecting the records of the National Guard. The trip back from Phœnix was made via the Roosevelt Dam, and even then the total flying time was 4 hours and 40 minutes, whereas the same trip on train with lay-overs for connections would take twenty hours.

Deliver Chickens By Aeroplane

Oakland.—One hundred and fifty chickens arrived at Durant Field via aeroplane from Santa Cruz. This is said to be the first time that chickens have flown so high. They had but recently been hatched.

Plan Aerial Races Next Year

The transcontinental aerial touring contests from New York to San Francisco and New York to Los Angeles have been changed to closed circuit contests by the new Contest Committee of the Aero Club of America, and Major Charles J. Glidden, President of the Aerial League of the World, has telegraphed to the President of the Aero Club of California, San Francisco, and the President of the Aero Club of Southern California at Los Angeles, that the contests will be conducted by the Aerial League of America in 1921 for cash prizes.

The contests will be open to all aviators in the world, including some 20,000 in the United States, and will be under rules similar to those governing automobile contests for cross-country touring, making them sane and safe.

Yolo Fliers' Club Holds Fine Meet

The big aerial meet staged at Woodland, Cal., by the Yolo Fliers' Club was an immense success viewed from every angle.

The planes began to arrive early in the morning and from 10 o'clock until 2 o'clock in the afternoon machines arrived every few minutes. Sixteen planes participated in the meet, ranging in size from the Balilla scout to the De Haviland bombers.

Fully 3,000 persons attended the event which marked the opening of the fliers' new club grounds four miles west of this city.

The aviators present were unanimous in declaring the new field to be the finest private field in the west. The grounds were rather dusty, but this undesirable feature will be eliminated when the plans of the directorate to plant grass on the runway have been carried out.

In the morning six big De Haviland Liberty motored planes from Mather Field flew over Woodland in battle formation and landed at the field.

The squadron was under the command of Captain Walsh. Original plans called for five planes from Mather, but at the last minute Cadet Jennings of the United States Forest Patrol entered his big ship.

The De Havilands were closely followed in landing by Dan P. Davison of San Francisco driving a Curtiss Oriole entered by the Earl P. Cooper Company. As passengers Davison carried J. H. Roxstall of the Hall Scott Motor Company and I. E. Elm of San Francisco.

The Italian Ansaldo Balilla piloted by Major Chambers was by far the fastest plane exhibited at the meet. The trip to Woodland from San Francisco was made in 40 minutes flat. The tiny craft carries but one passenger and is propelled by an S.P.A. motor of 200 horsepower.

The German Fokker entered by the Hall Scott Motor Company and equipped with one of their motors of 200 horsepower was very attractive. This craft was piloted by M. Deckert of the French army.

The big Bristol fighter also attracted considerable attention.

Two J. N. 4-D Curtiss planes were busy the entire day carrying passengers at $10 each. These machines were piloted by F. W. Farris and George Putington.

The Lincoln Standard, Hispano-Suiza motored plane, entered by the Walter Varney Company, was another hit of the meet.

Another Standard plane was entered by the Pacific Company. This plane flew to Woodland from Los Angeles.

The large gathering of prominent Frenchmen and Americans attending the unveiling of the Wilbur Wright monument at Le Mans, France. The monument stands 40 feet high; its base is carved with figures in bas-relief of Wilbur and Orville Wright and of Leon Bolée

The AIRCRAFT TRADE REVIEW

Travelers Insurance Company Covers Aeroplane Passengers

About a year ago The Travelers Insurance Company, recognizing that the aeroplane had a real future in the commercial world, stepped into the flying field as the first American insurance company to write public liability, property damage, compensation and personal accident insurance on aircraft and flyers. Now The Travelers has made another step forward, which is nearly as important as the one which brought it into the aerial world. It has entered the field as the first American company to write aircraft liability insurance covering the passenger hazard. That is, it stands ready to protect any aeril transportation company against suits which may arise from injuries sustained by the public while riding on their machines.

The rate for this insurance is based upon a percentage of the passenger earnings with a minimum sum per passenger trip. The maximum limits that will be written are $10,000-$30,000—that is, The Travelers will not accept a responsibility of more that $10,000 on any one person killed or injured in any one accident, or $30,000 on any two or more. Stunt flying is at all times prohibited under the contract, and passenger hazard insurance will not be written on any machine that does not carry Travelers property damage insurance and also compensation when the employer comes under that law.

1,000 Words a Minute by Radio

The new radio station soon to be erected on Lond Island near New York will contain an apparatus credited with being able to receive 1,000 words a minute. This instrument operates on a photographic principle. A lightweight mirror flutters in electro-magnetic tune with minute electric impulse coming from the big steel towers out in the field. The oscillations vary according to the Morse code of dots and dashes. The mirror reflects a beam of light on a moving sensitized tape. The tape goes through a developing fluid and the receiving operator reads off the message in dots and dashes at the rate of 50 to 100 a minute, just as one reads a broker's tape.

Complete Preliminary Work On Aerial Coast Station at Staten Island

Coincident with the burial recently of William Kissam Vanderbilt in the old Moravian Cemetery at New Dorp, S. I., was the completion of preliminary work on the new Miller Field, the first large aerial coast defense station on the Atlantic seaboard, now being laid out by the government, at an expense of $1,000,000, on what was the original Vanderbilt farm, on New Dorp Lane, S. I., where stands the historic old mansion in which W. K. Vanderbilt was born and spent many of his early years.

The Vanderbilt farm, comprising 450 acres with 1750 feet of frontage on the ocean, bounded on the land side by New Dorp Lane and Barnes Avenue, and extending almost to the Southern Boulevard, was purchased from the lawyers of the late William K. Vanderbilt, who had empowered them to put it on the market, on June 30, 1919, by the government for about $500,000, as one of the first practical steps taken in applying the appropriation of $8,000,000 voted near the close of the war for the improvement of the coast defense by means of aerodrome adjuncts.

The work of transforming the old farm into a modern flying field was commenced in November, 1919, and now the steel frameworks of the hangars have been erected and much of the rough farm land levelled and the early work is well along to completion. The officers in charge expect that it will be entirely finished by the first of next year.

The big mansion, built in 1829, where William K. Vanderbilt was born, and where his father, William H., had lived, still stands today, occupied as living quarters for the supervising contractors, and when the field is completed the mansion, estimated to be ninety years old, will be refitted as a club house for officers of the Air Coast Defense.

The work is in charge of Major Clarence H. Green of the construction division of the Quartermaster's Department, and Captain H. B. Andrews. Two civilian contracting firms, the Rangsley Construction Company and Smith, Hauser & McIsaac, have been busy building macadam roads, laying sewers and water lines, and levelling the beautiful oak and cedar trees that lined the winding Vanderbilt carriage drives in order to clear the way for the field where the aeroplanes will make their landings.

Aerial Campaign Planned

Indianapolis, Ind.—Dr. Aaron S. Watkins, Prohibition Party Presidential candidate, will start a campaign tour by aeroplane. The tour will cover all states east of the Rocky Mountains.

Curtiss Orioles Make Records

Two excellent flights were made recently by W. M. Fagley, secretary of the Curtiss-Indiana Company. Using a Curtiss Oriole three-seater plane, equipped with a K-6 150 horsepower motor, Mr. Fagley flew from Kokomo to Rantoul (130 miles) in eighty-two minutes. The plane carried, in addition to the pilot, one passenger and a full load of fuel. On the return, with a favoring wind, the Oriole made the trip in one hour. The 260-mile journey was negotiated in two hours and twenty-two minutes, an average of almost two miles a minute. Another journey, from Waukegan, Ill., to Kokomo (200 miles), was made in a Curtiss OX Oriole in two hours and thirty-five minutes.

Mr. A. H. Grayburn, for the past four years assistant to the vice-president of the "NORMA" Company of America, has been made assistant secretary and assistant treasurer of this concern.

Atlantic Fleet Aircraft Record

Navy Aircraft activities with the U. S. Atlantic Fleet in West Indian waters during the recent winter and spring months have been made public by the Office of Naval Intelligence. The total flights for all types of heavier-than-air machines, which includes N-9's, MF boats, and F-5-L's, numbered 218, with a total of 452.25 flying hours, and only seven forced landings occurred throughout the entire period. The work of the F-5-L squadron of six machines commanded by Lieut. Comdr. B. G. Leighton, U. S. N., included the passage from Pensacola to Guantanamo; general communication exercises and target flights at Guantanamo; a shaking down cruise which covered Cape Haitien, Sanchez, S. D., San Juan, P. R., St. Thomas, V. I., Ponce, P. R., Mayaguez, P. R., Aquin Bay, Haiti, Kingston, Jamaica, and return to Guantanamo; battle practice, bomb dropping, night flying, communication service, and general short range battle practice in Guacanayabo Bay and vicinity. The squadron of F-5-L's covered a distance, in formation, of 2,895 miles in fifty-nine hours and six minutes, at an average ground speed of fifty knots. The average fuel consumption of all machines was fifty gallons an hour at a speed of sixty flnots air-speed, a very fine performance.

The ideal method of transportation for the week-end golfer

Albert S. Burleson, Postmaster General
Otto Praeger, Second Assistant Postmaster General
Leon B. Lent, General Superintendent, Air Mail Service
Herbert Blakeslee, Assistant Superintendent
John A. Jordan, Chief of Construction

J. Clark Edgerton, Chief of Flying
Charles I. Stanton, Chief of Supplies and Maintenance
Carleton A. Parker, Assistant Chief of Maintenance
George L. Conner, Chief Clerk
John A. Willoughby, Operator in Charge of Radio Experiments

Eugene Sibley, Operator in Charge of Radio Maintenance and Operation

PILOTS

E. Hamilton Lee
Harold T. Lewis
James H. Knight
Walter H. Stevens
Robert H. Ellis
Randolph G. Page
Herbert M. Crader
Samuel C. Eaton
Elmer G. Leonhardt
Frederick A. Robinson
Walter J. Smith
Farr Nutter
Wesley L. Smith
Joseph P. Harris

Duard B. Colyer, Acting Superintendent, New York-Washington Division
Samuel F. Doane, Superintendent, New York-Cleveland Division
Walter H. Riddell, Superintendent, Cleveland-Chicago-Omaha Division
E. W. Majors, Superintendent of Repairs, Bustleton, Pa.
Eugene J. Scanlon, Manager, Air Mail Warehouse, Newark, N. J.
Paul W. Smith, Manager, Newark, N. J.
Maurice J. Kelly, Manager, Bellefonte, Pa.
Howard F. Salisbury, Manager, Cleveland, O.
Andrew R. Dunphy, Manager, Chicago, Ill.
William I. Votaw, Manager, Omaha, Neb.

PILOTS

Cecil R. Benedict
Oscar B. Santa Maria
James T. Christensen
Elmer C. Nichols
John J. McLaughlin
Harry Huking
Glenn V. Conrad
Irving Murphy
Claire K. Vance
Homer W. Johnston
William N. DeWald
Clarence C. Lange
William C. Hopson
W. J. McDonough
D. A. Martin

Request Bids for Aerial Mail Between Seattle and Victoria, B. C.

Postmaster General Burleson has asked bids for hydro-aeroplane mail service between Seattle, Washington, and Victoria, B. C., about 84 miles and back, from October 15, 1920, to June 30, 1921. A single trip each way carrying not exceeding 600 pounds of mail will be required. Bids will be received until September 14.

Under this plan the incoming mail from the Orient arriving at Victoria would be advanced for delivery at Seattle one whole business day over the present steamer service, and the outgoing mail now arriving at Seattle several hours late for the morning steamer dispatch to Victoria for trans-Pacific connection would avoid delay in final delivery in the Orient in many cases two or three weeks by reason of catching the vessel at Victoria.

Aerial Mail to Utilize Chanute Field

The Chief of Air Service has authorized the postoffice department to utilize Chanute Field, Rantoul, Illinois, for a landing field for the mail planes on the Chicago, St. Louis aerial mail route. Mechanics have been on the field overhauling and repairing planes. The planes to be used on the new aerial mail route are the JN type. Later on it is the intention of the division superintendent to replace the JN with DH-4's. The Air Service officers and enlisted men at Chanute Field are rendering all assistance possible. It is believed that the machines will be in good shape and ready to start over the route within the next few days.

Mail Planes Leave Curtiss Aerodrome

The aerial mail planes for Cleveland and Chicago now leave the new Curtiss aerodrome, formerly Hazelhurst Field, Mineola, L. I.,

The planes formerly left Heller Field, Newark. The mail planes for Philadelphia and Washington still leave from that field.

UNITED STATES POST OFFICE DEPARTMENT

CLEVELAND-OMAHA DIVISION—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, June, 1920

													SERVICE AND UNIT COST					
Aeroplane No.	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	Gallon of Gasoline	Total Time Run hr.	Total Time Run min.	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
10	$77.50	$16.46	$78.87	$53.21	$13.05	$94.61	$118.40	$275.54	$204.45	$46.24	$116.45	$1,094.78	266	14	30	910	3.4	$75.50	$1.20
12	7.50	.98	78.87	53.21	13.05	94.61	....	....	....	........*	116.45	364.67	25	....	....	....	....	....	....
15	23.06	5.95	78.87	53.21	13.05	94.61	26.54	213.21	63.65	46.24	116.45	734.84	79	3	15	220	2.8	226.10	3.34
17	68.70	16.14	78.87	53.21	13.05	94.61	116.09	232.13	211.15	46.24	116.45	1,046.64	236	14	13	910	3.9	73.62	1.15
64	129.97	22.32	78.87	53.21	13.06	94.61	49.13	370.42	3,357.08	36.48*	116.45	4,321.60	410	6	01	540	1.3	718.26	8.00
67	....	....	78.87	53.21	13.06	94.61	....	353.93	....	50.00	116.45	760.13	....	....	....	....	....	....	....
70	154.62	16.38	78.87	53.21	13.06	94.61	113.92	152.74	....	50.00	116.45	843.86	560	13	57	1,335	2.4	60.49	.63
75	....	....	78.87	53.21	13.06	94.61	....	142.37	305.78	50.00	116.45	854.35	....	....	....	....	....	....	....
76	79.29	13.26	78.87	53.21	13.06	94.61	69.09	253.91	1,979.48	50.00	116.45	2,801.23	288	8	28	710	2.5	330.85	3.95
79	....	....	78.87	53.21	13.06	94.61	....	88.40	....	50.00	116.45	494.60	....	....	....	....	....	....	....
94	166.17	17.36	78.87	53.21	13.06	94.61	151.48	246.95	421.53	50.00	116.45	1,409.69	480	18	33	1,810	3.8	75.99	.78
95	....	....	78.87	53.21	13.06	94.61	....	353.93	....	50.00	116.45	760.13	....	....	....	....	....	....	....
101	....	....	78.87	53.21	13:06	94.62	....	238.49	211.69	50.00	116.45	856.39	....	....	....	....	....	....	....
102	40.23	7.80	78.87	53.21	13.06	94.62	25.86	294.78	2,300.93	50.00	116.45	3,075.81	145	3	10	220	1.5	971.30	13.98
104	180.45	32.06	78.87	53.21	13.06	94.62	206.80	223.34	36.09	50.00	116.45	1,084.95	651	25	20	2,300	3.5	42.82	.47
106	192.24	22.77	78.87	53.21	13.06	94.62	155.83	367.43	88.85	50.00	116.45	1,233.33	703	19	05	1,760	2.5	64.63	.70
110	....	....	78.87	53.22	13.06	94.62	....	128.56	2,154.35	28.55*	116.45	2,667.68	....	....	....	....	....	....	....
111	264.56	15.51	78.87	53.22	13.06	94.62	256.82	304.68	7.85	92.14*	116.45	1,297.78	933	31	27	2,345	2.5	41.26	.55
201	942.34	128.29	78.87	53.22	13.06	94.62	549.57	642.49	227.60	200.00	116.46	3,046.52	3,222	67	18	5,100	1.6	45.24	.60
202	458.29	48.51	78.88	53.22	13.06	94.62	217.22	822.08	768.48	200.00	116.46	2,870.82	1,642	26	36	2,100	1.3	107.92	1.37
204	189.22	31.58	78.88	53.22	13.06	94.62	136.64	159.30	156.25	200.00	116.46	1,229.23	676	16	44	1,225	1.8	73.45	1.00
206	1,032.71	120.20	78.88	53:22	13.06	94.62	723.10	672.96	372.90	200.00	116.46	3,478.11	3,715	88	33	7,075	1.9	39.24	.49
24227	....	....	78.88	53.22	13.06	94.62	....	50.00	....	50.00	116.46	456.24	....	....	....	....	....	....	....
Total	$4,006.85	$515.57	$1,814.05	$1,223.90	$300.34	$2,176.14	$2,916.49	$6,587.64	$12,868.11	$1,695.89	$2,678.40	$36,783.38	14,031	357	10	28,560	2.0	$102.96	$1.29

Cost per mile, overhead, $0.27; cost per mile, flying, $0.25; cost per mile, maintenance, $0.76.
Planes Nos. 10 to 17, inclusive, Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
Planes Nos. 64 to 110, inclusive, and 24227, De Havilands, equipped with Liberty 12 motors.
Plane No. 111, Twin De Haviland, equipped with two Liberty 6 motors.

Planes Nos. 201 to 206, inclusive, Martins, equipped with two Liberty 12 motors.
*Indicates that plane appears on another report.

OTTO PRAEGER, Second Assistant Postmaster General.

PROPERTIES OF WOODS AT 10 PER CENT MOISTURE

By B. C. Boulton, Aeroplane Section, and R. L. Hankinson,
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ALTHOUGH a thorough knowledge and appreciation of the properties of structural woods are most important for aeroplane designers, comparatively little has been written on this subject. The most authoritative publication dealing with the properties of woods is Bulletin No. 556, issued by the Forest Products Laboratory of the U. S. Department of Agriculture. In this bulletin are two tables, the first giving the strength properties of all our important American woods in the green condition, the second giving these same properties for air-dried woods. The data from which these values have been computed have been obtained from over 130,000 standard tests, a sufficient number to determine very closely the true values of the various properties of the different species. The specimens were 2 x 2 in. in cross section. Those used for bending were 30 in. long; others were shorter, depending on the kind of test. Care was exercised to secure specimens with clear, straight grain so that the results would not be influenced by defects of any kind. These specimens were, as a rule, cut from the top 4 ft. of the 16 ft. butt log. The material for any given species and locality was cut from typical trees, usually five in number. The localities from which these trees were taken were distributed throughout the range of growth of the species. The trees chosen had grown under as nearly average conditions of soil and moisture as possible. The care that was thus used in the selection of the specimens eliminates very nearly variations in the properties that would be caused by these different factors.

In these tests by the Forest Products Laboratory the influence of the moisture content of the wood on its properties was for the first time fully appreciated, and the amount of moisture present in each specimen was recorded as an essential part of the data. The results of most tests on wood are practically valueless because the moisture contents of the test pieces were not obtained. This can be readily understood when one realizes that the change in the average value of most of the properties for a 1 per cent change in moisture content amounts to 4 per cent, roughly, and the moisture present varies from 5 per cent or less for kiln-dried material up to the fiber saturation point at 20 or 30 per cent for green timber. By fiber saturation point is meant that point at which the cell walls are saturated but the cells themselves contain no water. Any further increase in the moisture caused by the cells filling with water has no effect on the strength properties of wood. In both Tables 1 and 2 of Bulletin No. 556 the actual average moisture content of the specimens as tested is given. For this reason the different woods cannot be compared directly, nor can the values of the properties be used satisfactorily for design work.

Recognizing these facts, the Forest Products Laboratory, over two years ago, prepared for the use of aeroplane designers in the Navy a table of the strength properties of woods reduced to a standard moisture content of 15 per cent. These values are given in Table 1 of this article, and are suitable for the design of seaplanes, flying boats, and aeroplanes that are to be used in very moist climates. For most land aeroplanes, however, especially at the present time when practically all wood is kiln-dried, the moisture content will average approximately 10 per cent. To use the strength values of wood at 15 per cent moisture in such cases will evidently give an excess strength of about 20 per cent. The main purpose of the present article is to give the values of the strength properties of aeroplane woods reduced to the basis of 10 per cent moisture by the formula $S_2 = S_1 . 10a(M_1 - M_2)$, **in** which S_1 is the strength value as found from tests at M_1 per

TABLE I—*Properties of Woods at 15 Per Cent Moisture Content*

	COMMON AND BOTANICAL NAMES	Specific gravity based on volume and weight when oven-dry		Wght. at 15% moisture	Shrinkage from green to oven-dry condition		Static Bending				Compression parallel to grain	Compression perpendicular to grain	Shearing strength parallel to grain	Hardness perpendicular to grain (*a*)	Impact Bending		
		Average	Minimum permitted		Radial	Tangential	Fiber stress at elastic limit	Modulus of rupture **	Modulus of elasticity	Work to maximum load	Maximum crushing strength	Fiber stress at elastic limit			Fiber stress at elastic limit	Work to elastic limit	
				Lbs. per cu. ft.	*Per cent*	*Per cent*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*1,000 lbs. per sq. in.*	*Inch-lbs. per cu. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Pounds*	*Lbs. per sq. in.*	*Inch-lbs. per cu. in.*	
	HARDWOODS																
1	Ash, commercial white (*Fraxinus americana, Fraxinus lanceolata, Fraxinus quadrangulata*)......	.62	.56	40	4.5	7.1	7,700	12,700	1,500	14.2	6,000	1,300	1,750	1,150	15,220	7.3	1
2	Ash, black (*Fraxinus nigra*).....	.53	.48	35	5.0	7.8	5,800	10,500	1,400	14.1	4,900	800	1,350	740	10,020	4.1	2
3	Basswood (*Tilia americana*)....	.40	.36	25	6.6	9.3	4,700	7,200	1,300	6.4	3,800	400	880	340	8,350	3.1	3
4	Beech (*Fagus atropunicea*)......	.66	.60	41	4.8	10.6	7,400	12,600	1,500	13.3	5,900	1,100	1,700	1,060	16,430	7.4	4
5	Birch (*Betula lutea, lenta*)......	.67	.61	43	7.0	8.5	8,400	13,500	1,800	17.6	6,600	1,000	1,620	1,070	16,660	7.3	5
6	Cherry, black (*Prunus serotina*).	.53	.48	35	3.7	7.1	7,300	10,600	1,400	12.0	5,800	700	1,500	830	12,330	4.9	6
7	Elm, rock (*Ulmus racemosa*)....	.66	.60	44	4.8	8.1	6,700	12,500	1,400	19.3	5,800	1,200	1,650	1,200	14,260	6.4	7
8	Gum, red (*Liquidambar stryaciflua*).....................	.53	.48	34	5.2	9.9	6,700	10,400	1,400	11.0	4,900	700	1,500	650	16,090	8.1	8
9	Hickory (true hickories) (*Hicoria glabra, laciniosa, alba, ovata*)....................	.81	.73	50	7.3	11.4	8,900	16,300	1,900	28.0	7,300	1,800	1,800	....	19,910	10.1	9
10	Mahogany, true (*Swietenia mahogani*)....................	.54	.50	36	3.5	4.2	7,000	10,000	1,300	9.1	5,500	1,000	1,420	860	....	....	10
11	Mahogany, African (*Khaya senegalensis*).................	.50	.46	34	4.8	5.5	7,100	10,400	1,400	10.3	5,100	900	1,270	730	....	....	11
12	Maple, hard (*Acer saccharum*)..	.66	.60	42	4.8	9.2	8,100	12,900	1,600	12.9	6,500	1,200	1,990	1,200	16,100	7.5	12
13	Oak, commercial white (*Quercus alba, macrocarpa, minor, michauxii*)...................	.72	.65	46	5.3	9.2	6,700	12,000	1,400	12.7	5,900	1,300	1,760	1,270	14,980	6.6	13
14	Poplar, yellow (*Liriodendron tulipifera*) (*)................	.42	.38	28	4.1	6.9	4,800	7,500	1,300	6.2	4,100	400	900	370	11,290	4.6	14
15	Walnut, black (*Juglans nigra*)..	.56	.52	38	5.2	7.1	7,900	11,900	1,500	13.1	6,100	1,000	1,300	950	14,000	6.4	15
	CONIFERS																
16	Cedar, Port Orford (*Chamaecyparis lawsoniana*)............	.47	.42	31	5.2	8.1	6,200	10,300	1,700	9.7	5,300	700	1,160	580	13,070	4.7	16
17	Douglas Fir (*Pseudotsuga taxifolia*)....................	.52	.47	34	5.0	7.9	6,800	9,700	1,780	7.2	6,000	750	1,020	580	10,930	3.7	17
18	Fir, amabilis, grand, noble, white (*Abies, amabilis, grandis, nobilis, concolor*)............	.41	.38	27	4.0	8.3	5,100	8,000	1,400	7.1	4,500	520	880	380	9,350	3.4	18
19	Hemlock, western (*Tsuga heterophylla*)..................	.43	.40	28	4.5	7.9	5,200	8,400	1,400	6.0	4,600	490	920	490	9,330	3.5	19
20	Pine, sugar (*Pinus lambertiana*).	.39	.36	27	2.9	5.6	5,300	7,400	1,100	5.0	4,300	540	950	410	8,940	3.6	20
21	Pine, western white (*Pinus monticola*)..................	.45	.40	29	4.1	7.4	5,100	7,800	1,400	6.9	4,800	480	670	360	10,230	3.6	21
22	Pine, white (*Pinus strobus*)...	.39	.36	27	2.2	5.9	5,100	7,400	1,200	6.1	4,500	530	850	380	7,890	2.7	22
23	Pine, western yellow (*Pinus ponderoso*).................	.42	.38	28	3.9	6.4	5,300	7,900	1,200	5.9	4,500	590	960	400	8,640	3.4	23
24	Pine, Norway (*Pinus resinosa*).	.51	.46	33	4.6	7.2	7,900	10,900	1,700	6.1	6,100	720	1,150	540	13,290	5.3	24
25	Spruce, red, white, sitka (*Picea rubens, canadensis, sitchensis*).	.41	.36	27	3.9	7.5	5,100	7,900	1,300	7.4	4,300	500	920	430	9,740	3.5	25

(*a*) Load required to embed a 0.444-inch steel ball in the wood to a depth of 0.222 in.
(*) Includes Cucumber (*Magnolia acuminata*) and Magnolia (*Magnolia foetida*).

** For rectangular sections only.

cent moisture, and S_2 equals the strength adjusted to 10 per cent moisture; "a" is a constant derived from experiment. This formula and the values of "a" used are the result of work done at the Forest Products Laboratory. The woods included in Table 2 were taken from Signal Corps Specification 15,020-B for aeroplane woods. Only those species listed in Col. 2 of this table are permitted under the above specification.

With the exception of elm, all the values in Table 2 are averages of the properties of each of the species, listed in Col. 2, of the wood in question. In the case of elm the properties of rock elm only were considered. As the average specific gravities of slippery and white elm are .54 and .51, respectively, while the specific gravity requirement in Col. 3 for elm is .60, any specimens of slippery or white elm meeting this requirement will have strength values equal to those of rock elm. It should be further noted that the values for the moduli of rupture in Col. 7 are for rectangular sections only. With routed sections a large decrease in the modulus of rupture occurs, which varies with the degree of routing. Tests have been conducted to determine quantitatively the value of this decrease. Three series were run, the first with very slight routing, the second with normal routing, and the third with excessive routing. There were ten routed specimens in each series except series two, in which there were fifty, and for each routed specimen there was a matched solid specimen. All specimens were of the same outside dimensions, 2¼ x 1½ in. As a result of a study of the data from these tests, the following empirical formula was obtained, which it is believed will give reasonably accurate values for the modulus of rupture of spruce or fir spars of a normally routed I section:

$$F_R = \frac{1.12\ F_S\ I_S}{I_R}$$

F_R = modulus of rupture of routed section.
F_S = modulus of rupture of solid section.
I_R = moment of inertia of routed section.
I_S = moment of inertia of a solid rectangular section of same area and center height as the routed section.

Further experimental work is being done to verify this formula and also to determine the effect of routing on strength in horizontal shear which is reduced probably even more than the modulus of rupture. The value of 750 lbs. per square in. that is given below for spruce is for routed sections. In calculating the shear in solid sections, such as is produced by bolts which are subjected to pull parallel to the grain of the wood, as in a longeron splice, the values of the shear strength listed in Col. 12, Table 2, may be used.

For the reasons that spruce is so largely employed for highly stressed members in aeroplane structures, and that each of the three species of spruce are in common use, the working values for the various properties recommended for design work are not the average of these properties for the three species, but, in the case of the ultimate compressive strength parallel to the grain, are the lowest of the three values, and in the case of the modulus of elasticity and ultimate horizontal shear are values which experience has shown to be suitable.

STRENGTH VALUES FOR SPRUCE

Modulus of Rupture	Modulus of Elasticity	Ultimate Compression Strength Parallel to Grain	Horizontal Shear
Lbs. per sq. in.	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*
10,300	1,600,000	5,500	750

In Fig. 1 is given a curve showing the reduction in stress that is necessary to allow for column action in spruce columns. Similar curves for other woods may be constructed by the aid of the formulas in Fig. 1. Interplane struts, as a rule, fall in the class of slender columns, and their strength may therefore be computed by Euler's formula for pin-ended columns. This formula is not applicable to spruce or fir struts with an L/P less than 90 to 100. For center section struts use Johnson's formula or the curve in Fig. 1 for pin-ended columns.

Where members, such as wing beams, are subjected to both bending and compression, the following method of calculating ultimate allowable stresses is recommended. It should be realized, however, that the formula used will not give safe ultimate stresses when the value of L/P exceeds about 90. This is because sufficient allowance is not made for column action when L/P is large.

$$f_a = \frac{f_b}{f_b + f_c}(F - C) + C$$

f_a = ultimate allowable stress.
f_b = calculated stress due to bending.
f_c = calculated stress due to compression.
F = modulus of rupture.
C = maximum allowable P/A as determined from the curve for pin-ended columns in Fig. 1.

When considering a point near mid-span the length of the column may be conservatively taken as equal to the span. At inner strut points where column action is present the column length may be taken as equal to .25 the span on one side of the strut plus .25 the span on the other side. At cantilever strut points C equals the full compressive strength of the material.

The weights in Col. 4 of Table 2 are calculated by using the specific gravities, given in Bulletin No. 556, which are averages for the species and are based on oven dry weight and air dry volume, to compute the weight of a cubic foot of dry wood. This weight is then increased by 10 per cent to allow for the moisture.

It has been suggested that the values of the properties of woods at the elastic limit, rather than at the breaking point, be employed in aeroplane design. In spite of certain advantages

TABLE II—*Properties of Woods at 10 Per Cent Moisture Content*

Wood	Species Permitted Under Specification	Minimum Allowable Specific Gravity**	Average Weight per c. f. at 10% Moisture	Static Bending				Impact Bending	Max. Compression		Shear Parallel to Grain
				Work to Maximum Load	Fiber Stress at Elastic Limit	Modulus of Rupture	Modulus of Elasticity	Fiber Stress at Elastic Limit	Parallel to Grain	Perpendicular to Grain at Elas. Limit	
			Lbs.	*In. Lbs.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. sn.*
HARDWOODS											
Ash	White, Green, Blue and Biltmore	.56	39.5	13.8	9,050	14,600	1,620,000	17,500	7,830	1,630	1,950
Ash	Black	.48	34.5	15.4	8,500	14,100	1,690,000	12,400	7,000	1,100	1,760
Birch	Sweet, Yellow	.61	44.5	18.7	12,250	18,600	2,140,000	23,200	9,880	1,500	2,200
Basswood		.36	26.5	8.0	6,600	9,500	1,500,000	10,500	5,430	520	1,160
Cherry	Black	.48	35.0	11.1	10,450	13,400	1,530,000	14,300	8,000	970	1,870
Elm	Rock, White and Slippery	.60	45.0	18.7	8,550	15,800	1,580,000	17,400	7,940	1,690	2,010
True Hickory	Pignut, Mockernut, Shagbark and Shellbark	.73	51.0	25.2	11,400	21,200	2,250,000	23,100	10,070	2,500	2,200
Hard Maple	Sugar	.60	42.5	13.7	10,700	16,100	1,830,000	19,500	8,780	1,670	2,500
Mahogany	African	.46	33.0	11.1	9,200	12,200	1,540,000	....	6,200	1,170	1,520
Mahogany	True	.50	36.0	8.3	9,100	11,200	1,380,000	....	6,680	1,300	1,700
Oak	Bur, Cow, Post and White	.65	46.5	12.3	8,150	14,100	1,580,000	18,100	7,490	1,680	2,100
Poplar	Cucumber, Magnolia and Yellow	.45	32.5	11.1	7,450	11,800	1,580,000	15,200	6,550	810	1,310
Walnut	Black	.52	39.0	9.7	10,000	14,300	1,680,000	15,400	7,810	1,350	1,170
CONIFERS											
Cedar	Port Orford	.42	31.0	10.6	8,350	13,800	2,000,000	16,900	7,300	960	1,440
Douglas Fir	Coast	.45	35.0	7.9	8,200	12,000	2,060,000	12,100	8,440	940	1,080
Fir	Amabilis, Grand, Noble and White	.38	27.0	8.4	6,550	10,200	1,610,000	10,900	6,280	680	1,020
Hemlock	Western	.40	29.0	6.0	5,800	9,600	1,460,000	10,600	6,540	600	950
Pine	Eastern White	.36	27.0	6.4	6,950	9,500	1,420,000	9,300	6,320	760	1,070
Pine	Western White	.40	29.5	9.3	6,900	10,300	1,620,000	13,600	6,780	700	540
Pine	Norway	.46	33.0	10.5	10,600	13,600	1,830,000	16,600	8,110	950	1,380
Spruce	Red, Sitka and White	.36	27.0	9.0	6,750	10,300	1,510,000*	11,800	5,970*	720	1,100*
							1,600,000*		5,500*		750*

**Minimum specific gravity is based on oven dry weight and oven dry volume which would be obtained by keeping within the elastic limit, design is based on ultimate strengths for the following reasons: 1. The values in Tables 1 and 2 for ultimate or breaking strengths are more reliable than those for elastic limit properties because in test they are more definitely marked and the personal equation of the observer does not enter so largely. 2. In certain woods the margin between the elastic limit and the ultimate strength is large, and in other cases comparatively small. Hence, similar structures built of different woods, but designed to have the same strength factor based on the elastic limit, might, if tested to destruction, show quite a difference in breaking load. 3. Most aeroplane structures are subjected to static destruction tests and are required to sustain a certain ultimate load factor. For this reason it is necessary to design for this factor rather than for the factor at which the elastic limit of the structure is reached, a point which it would be impracticable to determine. 4. The extremely severe loads imposed upon an aeroplane in maneuvering are applied for only a very brief time. Wood is a material which can be stressed well above the elastic limit, almost to the breaking point, without serious injury, provided the load is removed within a fraction of a second, a condition that occurs when an aeroplane is suddenly pulled out of a steep dive.

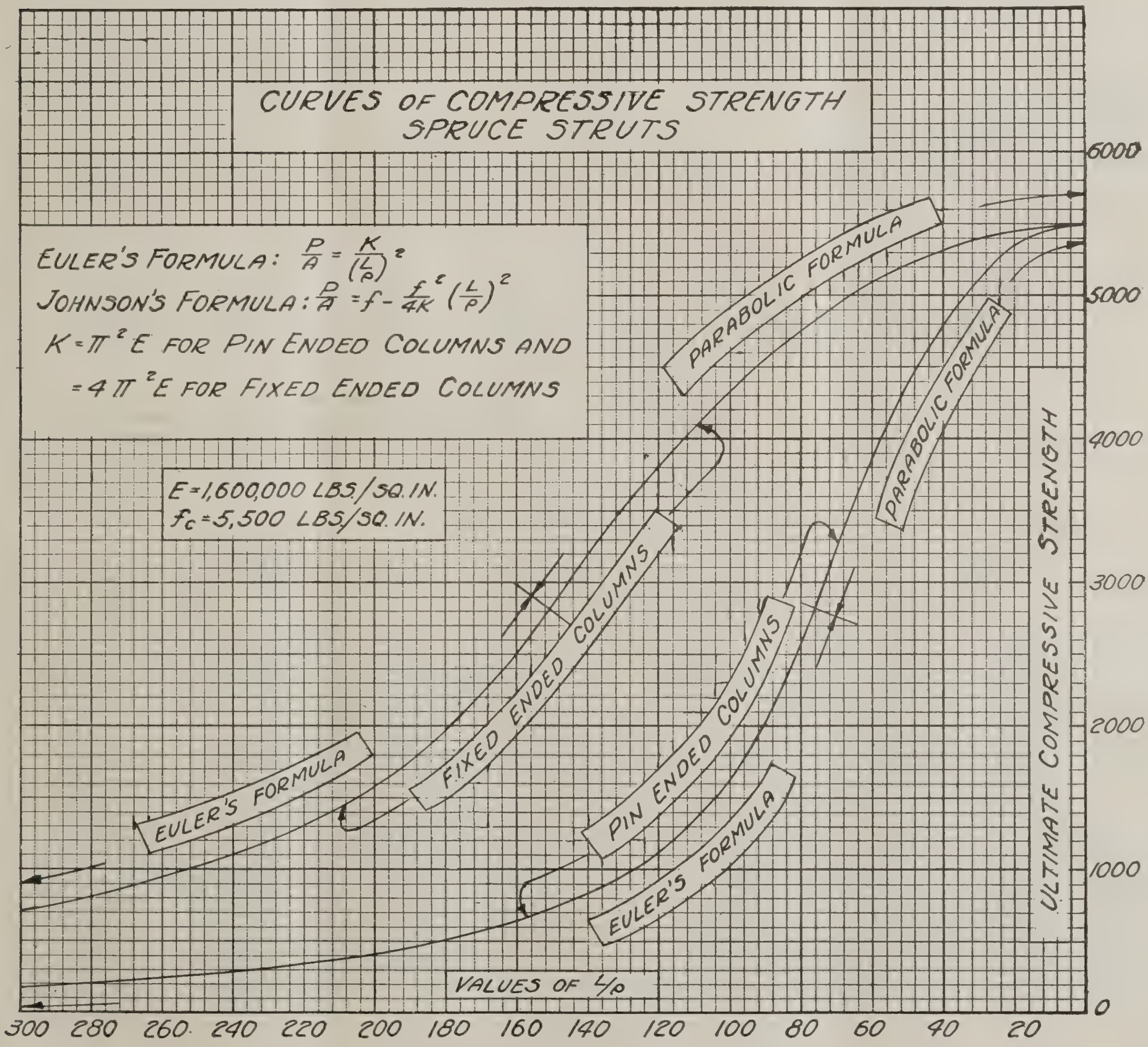
The Effect on the Strength Properties of Wood of Spiral and Diagonal Grain

In determining the true slope of grain in any piece of wood two kinds of sloping grain must be considered, namely: (1) diagonal grain, or the slope of the annual growth layers with respect to the axis of the piece and (2) spiral grain, or the slope of the wood fibers within these annual layers. Diagonal grain is caused by the fact that the stock is not sawn parallel to the annual growth rings. Its maximum value occurs on a radial face. Spiral grain is a maximum on a face tangential to the growth rings. Frequently in inspection when a piece has both spiral and diagonal grain it is wrongly classified as having a grain with a slope equal to the slope of either the diagonal or spiral grain, depending on which had the greater slope. The point should be emphasized that when two slopes are present the resultant slope is greater than either single slope. Classification on the basis of absolute or resultant slope is the only safe and correct method. Suppose the slope of the diagonal grain is 1 in 15 and that of the spiral grain 1 in 20, the absolute slope $= \sqrt{\left(\frac{1}{20}\right)^2 + \left(\frac{1}{15}\right)^2} = \frac{1}{12}$ or a slope of 1 in 12. Classification by the method of greater slope may admit material 15 per cent lower in average strength properties.

Tests show that the damaging effect of combined spiral and diagonal grain is the same as that of spiral or diagonal grain of the same absolute slope, and that spiral grain is no more harmful than diagonal grain of the same degree. However, it is more likely to escape detection, and spiral-grained material is more subject to deterioration from season checks than diagonal-grained.

Table 3 gives quite complete data on the effect of spiral grain on the strength properties of Sitka spruce and Douglas fir. Plots showing the decrease in the value of the different properties bring out the fact that some properties are affected by slightly

(Continued on page 30)



THE B. M. W. AERO ENGINES

THE B.M.W. (Bayerische Motoren Werke) aero engine has aroused considerable interest because of the remarkable performances which have recently been established in the United States by the JL-6 all-metal monoplanes which are equipped with this power plant.

The B.M.W. engines are designed as super compression high altitude engines and must be regarded as pioneer efforts in this field of aero engine construction. The qualities of these engines are exemplified by the following four points:

1. Simplicity of construction, easy manipulation, reliability and great strength, insensibility to external influences even when being handled by inexperienced pilots.

2. Remarkably low fuel consumption even when using low-grade fuel with almost fully throttled motor flying at great heights. Consequently, great range of action at high speed and low cost of running, which is an important factor for aerial post service and traffic.

3. Constant output up to very great altitudes. A minimum decrease of power only at abnormal heights. (It is a well-known fact that the usual type of aero engine greatly diminishes in efficiency as the height increases; a drawback which becomes noticeable already at comparatively low altitudes.)

4. Possibility of temporarily overtaxing the motor by fully 20 per cent above its normal output. (This is of very great importance when starting from difficult ground, rough sea, and especially when carrying abnormally heavy loads and for overcoming sudden handicaps.)

Special Features

Up to a normal output of 220 h.p. the propeller is coupled directly to the crankshaft. The more powerful types have a specially designed reduction gear.

A remarkable feature of the B.M.W. altitude motor is that the r.p.m. of the propeller increase with the increase in height, whereas in the usual type of engine the r.p.m. decrease. For example, the type B.M.W.IIIA. increases by about 150 and B.M.W.IV by about 180 revolutions per minute. These facts have to be considered when choosing the respective propellers.

Cylinders

These are made from a special steel and the cooling jackets are made of steel-plate welded to the cylinders.

Pistons

The pistons consist of a high-grade aluminium alloy. The pistons, apart from the advantage of being of low weight, possess most favorable heat-conducting qualities; these qualities adding greatly to the remarkable smooth working and reliability of the motor.

Crankcase

This also consists of cast aluminium and is braced by strong hollow cross ribs through which the combustion air is drawn into the carburetor, thus enabling an effective cooling of the bearings within the crankcase. On its way to the carburetor the current of fresh air passes between the bottom of the lower crankcase and an aluminium casing thereto; it also passes the ribbed oil chambers and thus effects an additional cooling of the crankcase as well as of the oil contained therein.

Valve and Valve Gear

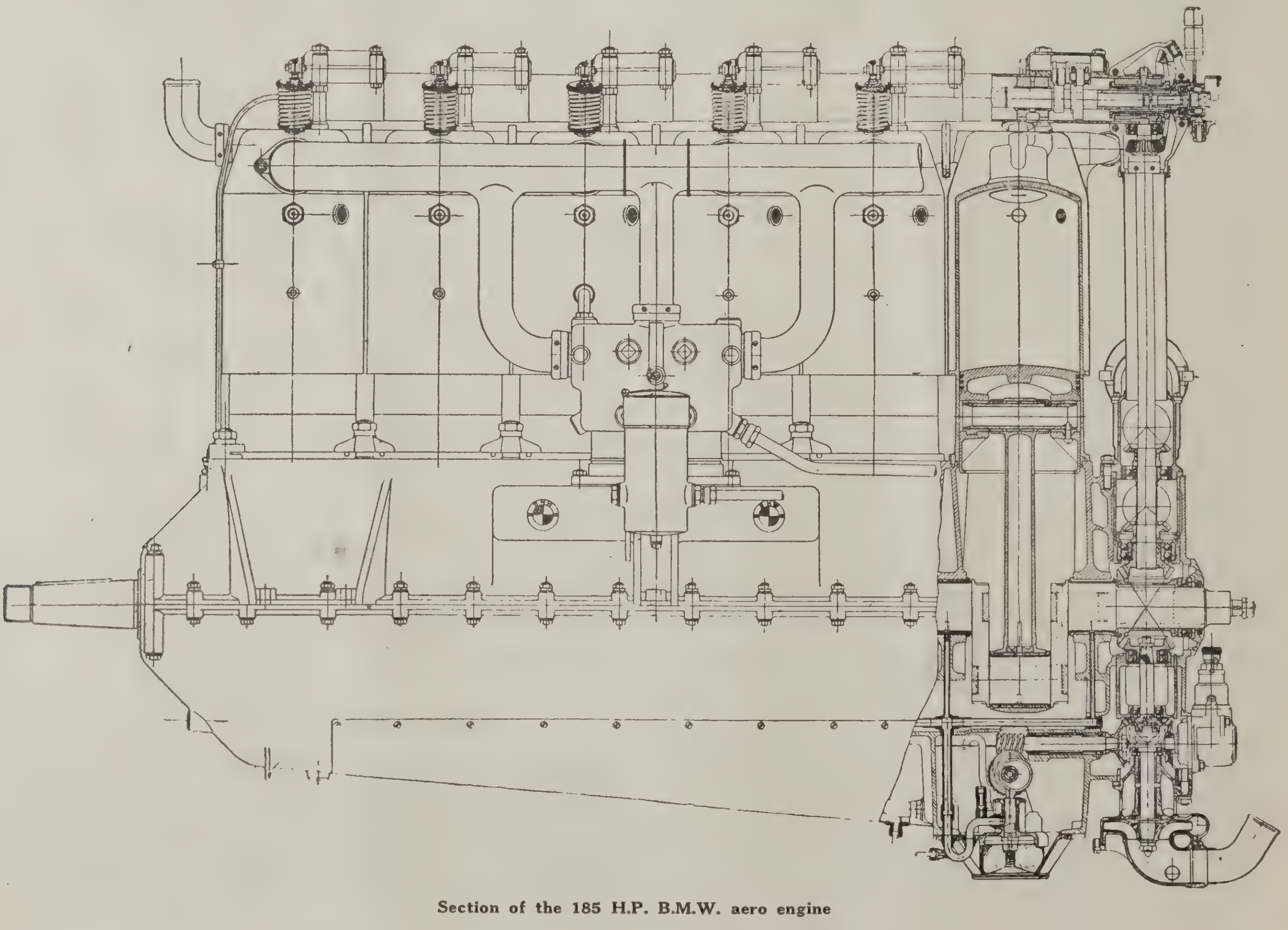
Both the admission and the exhaust valves are set at an angle in the cylinder heads. They are opened and closed by rocking levers operated by the cams on a camshaft. This valve-operating gear is oil-tight within a casing above the cylinders, and the camshaft is driven by means of bevel wheels from a vertical shaft on the suction side of the motor. This shaft, which also drives both magnetos, can in addition be used for driving any auxiliary apparatus which may be ordered with the motor.

Carburetor

All B.M.W. motors for aerial purposes are fitted with a patent high-altitude carburetor which guarantees minimum fuel consumption at all altitudes, even when throttled. This carburetor, by reason of its special design, has played an important part in the achievements of these engines.

Fuel

The B.M.W. motors may be driven on light gasoline, heavy gasoline, benzole, or



Section of the 185 H.P. B.M.W. aero engine any of the usual mixtures without any alteration having to be made.

Ignition

Ignition is produced by two bevel wheel driving high-tension Bosch magnetos mounted at the suction side of the motor and co-operating each with one set of sparking plugs.

Lubrication

The lubricating system is most carefully devised; it is a continuous system wherein the oil is circulated by a pump. After completing its circuit the oil is collected in the crankcase to be used again together with an addition of a small quantity of fresh oil. The oil level is maintained at a constant height by a fresh-oil and a scavenging pump. Inclined positions of the motor do not affect the lubrication.

The engines are fitted with all the accessories of modern motor engineering, such as half-compression devices, air pressure pumps, pre-heating arrangements, etc., and if desired can be provided with wireless installation, lighting and heating set, etc., without difficulty.

Particulars of the B.M.W. Engines

Type of motor	BMW II	BMW IIIA	BMW IV
Horse-power	120	185	220
Number of cylinders	6	6	6
Bore (inches)	4.7	5.9	6.3
Stroke (inches)	6.3	7.1	7.5
Continuous normal output at ground level at 1,400 revs. per min. (h.p.)	140	185	220
Normal number of revolutions of propeller per minute	1,400	1,400	1,400
Output remains constant to a height of (feet)	—	11,700	15,000
Output can be temporarily increased at ground level to (h.p.)	—	240	265
Fuel consumption per h.p. hour (oz.)	8.1	7	6.7
Lubricating oil per h.p. hour (oz.)	0.42	0.35	0.28
Service weight of engine, excluding water, oil and propeller hub (* including reducing gear) (lb.)	465	*630	650
Weight of cooling water (lb.)	19	27.5	22
Weight of oil in crank casing (lb.)	7.7	8.8	8.8
Weight of propeller hub (lb.)	11.4	14.4	14.4

The following further data which were published by the British Air Ministry amplify the foregoing.

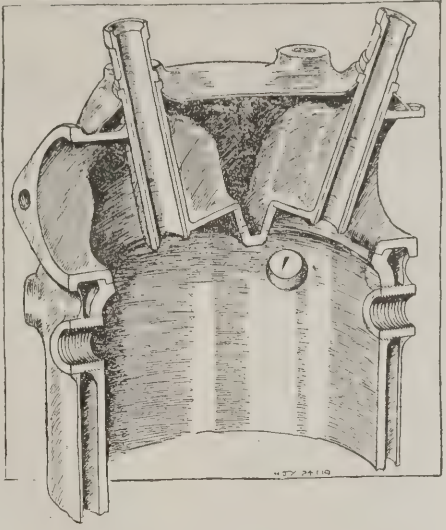
The general arrangement follows very closely standard German practice, the outstanding features being the very high compression ratio of 6.42 to 1 and the novel carburetor.

The cylinder construction is simple, barrel and head being machined from one forging, with valve pockets pressed and welded into the heads. The valves are inclined at an included angle of 30 deg.

Both inlet and exhaust valve stems are water-surrounded, recesses being formed in the valve pockets as shown clearly in a sketch.

Pistons

The pistons are strongly ribbed and of excellent material; they are fitted each with three narrow concentric piston rings,



Section of the B.M.W. cylinder head

which are internally peened for half their circumference.

Steel bushes are cast into the gudgeon pin bosses, and the gudgeon pin is held therein by a setscrew.

Connecting Rods

The connecting rods are of tubular section, machined all over, and taper slightly in outside diameter. Floating gudgeon pin bushes are fitted to the small ends. The big ends are fitted with two bolts only.

Phosphor bronze big-end shells lined with white metal are used, and the bronze shells are cut with an internal screw thread to give a seating for the lining.

The tubular connecting rods act as oil ducts to the gudgeon pin bearing. Instead of the usual small pipe leading up the con rod, the bottom end of the rod is fitted with a steel disc plug whereinto a small 4 mm. tube projecting up into the rod for about 40 mm. is screwed. A further small hole is drilled through into the little end from the interior bore of the rod.

Valves and Valve Gear

Inlet and exhaust valves are of similar form and size, of 72 mm. maximum diameter, 13 mm. stem diameter and of an overall length of 153.5 mm.

Single springs are fitted to the inlet valves, and concentric double springs to the exhaust valves. The spring washers are screwed onto threads cut in the valve stem end and locked by split-pins.

Camshaft

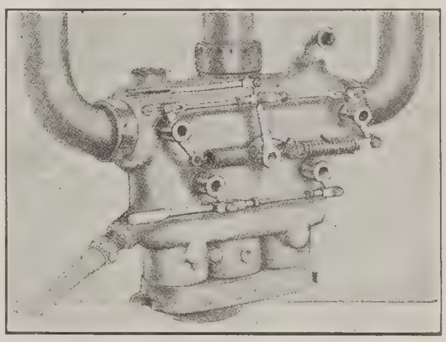
The camshaft follows very closely Mercedes practice, but in the casing a steel forging machined all over replaces the malleable casting used in the prototype, and the valve rocker covers are of aluminium. Some 7½ lbs. is thereby saved.

Crankshaft

The illustration shows the formation of the crankshaft. The cross-section of the shaft and of the crank pins increases progressively from the magneto end to the airscrew end—owing to the diameter of the bore being successively reduced.

Flanged brass discs, expanded into grooves, close the ends of each of the holes.

A single ball thrust race, housed in a split steel casing in the crankcase, is fitted at the airscrew end.



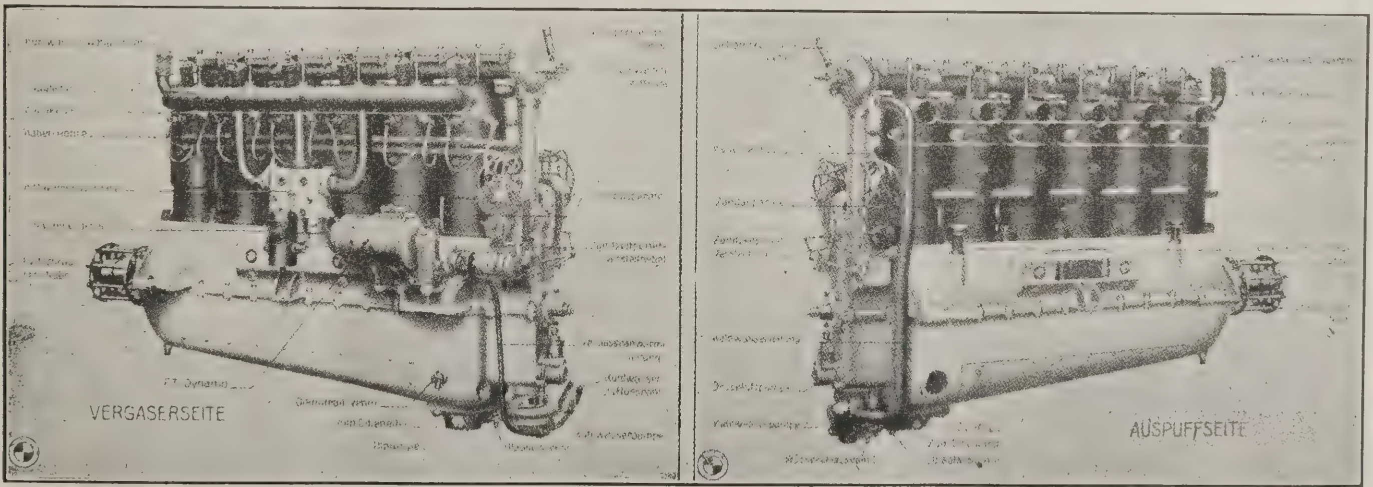
The B.M.W. carburetor

Crankshaft bearings are steel shells, white metal lined, with an internal thread in the shells similar to those of the big ends.

The Carburetor

The carburetor is of very unusual design. It is shown in a sketch. It consists

(*Continued on page* 18)



Intake and exhaust views of the B.M.W. aero engine

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The Textbook of Naval Aeronautics.

The Textbook of Military Aeronautics.

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(*Continued from page* 15)

really of three carburetors with a common float chamber. Each of these carburetors has a separate induction pipe leading up to the induction manifold.

The central carburetor has two jets—a pilot and a main jet. The outer two carburetors have one jet each. Five throttle valves are employed, arranged in two systems with independent control. The main system comprises three throttles, one to each carburetor.

The secondary system—which is an altitude control—has two valves on the two outer carburetors.

The action is described as follows:

When the main throttle is opened slightly, the pilot jet only (centre carburetor) is in action and mixture from the central carburetor alone reaches the cylinders. As the throttle is opened further the main jet comes into action, and the centre carburetor supplies the whole mixture till the throttle is half open. After this the two side carburetors come into action.

Only a relatively rich mixture is supplied by the two side carburetors, as the secondary throttles are closed and have only relatively small slots in them to pass gas, and the actual mixture supplied to the engine under these conditions is correct for ground level running.

Opening the secondary system of throttles reduces the strength of the mixture from the side carburetors and acts as an altitude control.

It is obvious—in view of the B.M.W. firm's statement—that half throttle, or the point where the side carburetors just do not supply any gas, is the normal continuous ground level full power position, and that the opening of the two side carburetors is only to be used for emergencies at ground level, and as altitude is gained.

The following figures of a one-hour test are of interest:

Average r.p.m., 1,400.
Average b.h.p., 216.
Average water inlet temperature, 63° C.
Average water outlet temperature, 74° C.
Average oil pressure, 24 lb. sq. in.
Oil consumption, 8 pts. per hr.—0.037 pts. per h.p. hr.

Fuel consumption (50 per cent. benzol), 94 pints per hour = 0.431 lb. h.p. hr.

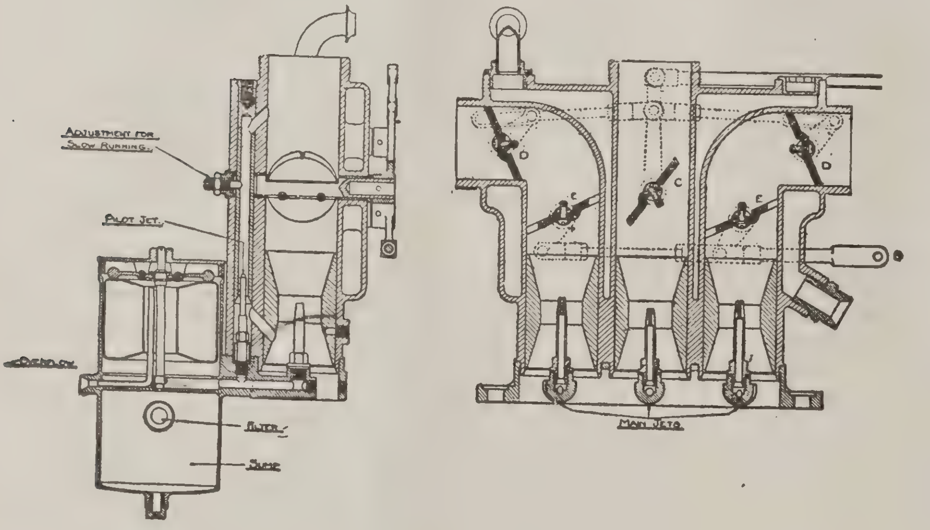
Consumption figures from other tests are given as:

R.P.M.	1,200	1,400	1,600
B.H.P.	203	234	254
Fuel (lb. per h.p. hour)	0.412	0.418	0.421

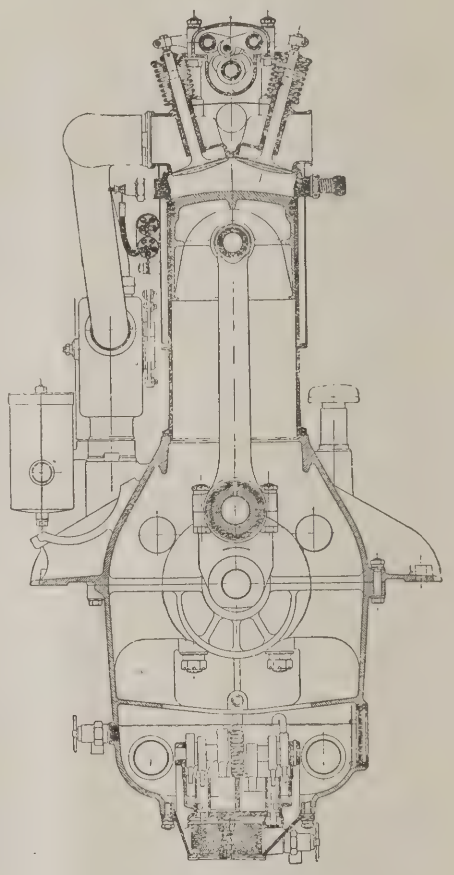
It will be seen that these figures show a very fair agreement with the makers' claim of 7 oz. per h.p. hour, which is 0.437 lb. when throttled to 185 h.p. at 1,400 r.p.m.

The weight of the captured example is given at 643.5 lb., or slightly heavier than the makers' figure.

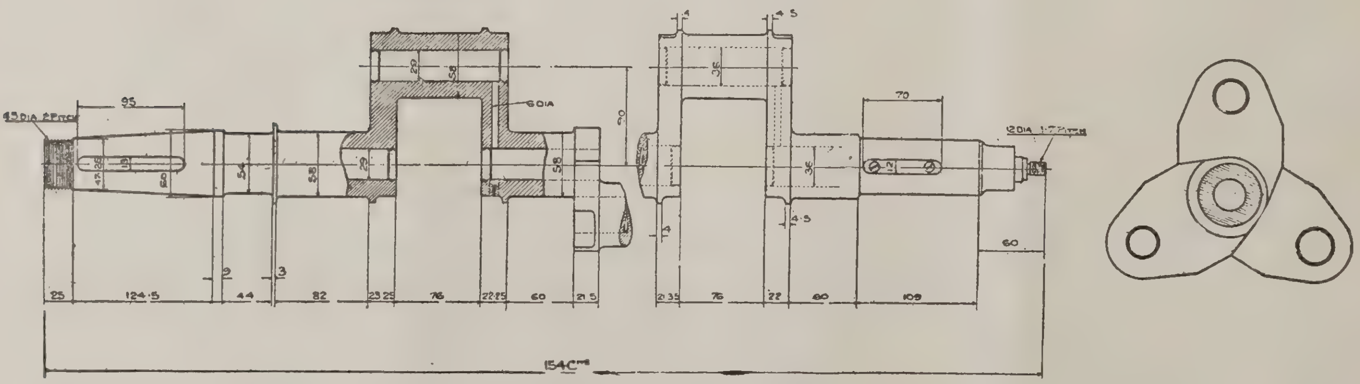
Altogether the engine must be acknowledged to be a very interesting piece of work, and its overload tests at the R.A.E. would seem to indicate that it is very conservatively rated by its makers.



Sections of the B.M.W. carburetor



Sectional end view of the B.M.W. engine

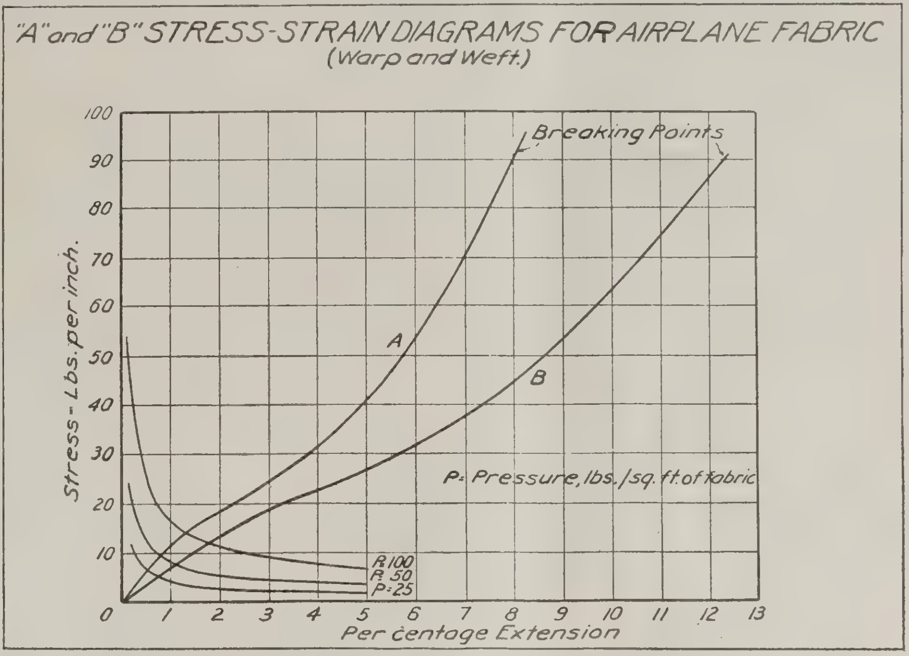


Crankshaft of the B.M.W. engine

RELATION OF RIB SPACING TO STRESS IN WING PLANES

By A. F. ZAHM

(Technical Note No. 5, National Advisory Committee for Aeronautics)



"A" and "B" STRESS-STRAIN DIAGRAMS FOR AIRPLANE FABRIC
(Warp and Weft.)

Preface.—The change of spacing between ribs in a wing plane may entail: (1) Change of air pressure, both in distribution and amount; (2) change of fiber stress in the fabric and the ribs, unless they be so altered in dimensions as to keep their stresses constant. The aerodynamic effect just stated should be studied in the wind tunnel, or, still better, in full-scale flight, with pressure collectors at many points on a medium section of the wing. The stress relations to the fabric and the rib will be considered in some detail here.

Fiber Stress in Fabric and Rib

Stress in Fabric.—It can be shown—see appendix—that the tensile stress (t) per unit width in the fabric of a wing plane, at a point where the resultant air pressure on it is (p), is approximately

$$t = pa^2/8c$$

(a) being the distance between the ribs and (c) the depth of bulge of the fabric midway between ribs at the locality in question. Hence keeping constant the air pressure (p), and the shape of bulge, or c/a, the lineal tension (t) varies directly as (a). If, then, the fabric thickness be directly as (a), the fiber unit stress is the same for all practical rib spacings. And, conversely, if the fiber unit stress remain constant, with varying rib distances, the bulge shape must remain constant, assuming the initial tautness the same in all cases.

Stress in Rib.—By well-known mechanics the unit stress in a simple beam, with either a concentrated or a uniform load, is of the form

$$S = A\frac{WL}{bd^2}$$

in which W is th load, L the length, b the width, d the depth. If the wing plane and its ribs remain geometrically similar, b and L increase directly as d, and W as d^2, since W varies as the area. The stress therefore takes the form

$$S = K\frac{d^2.d}{d.d^2} = \text{const.}$$

Conclusion.—Considering, therefore, the wing plane simply as a static structure, and ignoring the question of aerodynamic efficiency, it appears that the unit stress in the rib and fabric will remain constant for contact p if the linear dimensions of both rib and fabric be increased alike, viz., if wing and fabric remain geometrically similar. Since the bulge as well as the structural dimensions remains geometrically similar, the whole distended plane remains so, and hence should have the same pressure distribution and efficiency. If therefore the Burgess rule of making the rib spacing always one-fifth of the chord of the plane be valid for any one plane, it must be valid for all others that are mechanically similar in structure and covering.

Stress Strain Relations in Wing Plane Fabric

To determine whether a given fabric is suitable for a given rib spacing a stress-strain diagram is made for samples of the fabric. The relation is roughly

$$t = k\,e,$$

in which k is a constant, and e is the true strain, that is the stretch of a given length of sample divided by the unstretched length. If in the wing plane, a be the rib distance, r the radius of the bulge, the stretch of a is arc—less chord $= a^3/24\,r^2$, by a well known property of small circular arcs. Dividing this by the original chord length a gives the strain,

$$e = a^2/24\,r^2.$$

Instead of r we may write its value, t/p, from hydrostatics, and obtain a stress-strain relation for the bulge

$$24et^2 = a^2\,p^2.$$

This, for any fixed a, p, is a hyperbola in e, t, and may be plotted on a chart with the linear relation $t = k\,e$, as in Plate I.* Their intersection gives the actual tension generated by the air pressure p when the particular fabric represented by $t = k\,e$ covers the rib spacing a with initial tension zero. For any initial strain e_0 the hyperbola would be $24\,(e - e_0)\ t = a^2\,p^2$, or the former curve shifted laterally by an amount e_0.

Appendix

TO PROVE $t = pa^2/8c$—If p, a, c, denote, as before, the unit resultant air

(Continued on page 20)

Depth of Bulge c	Tension t in Pounds per lineal Inch for Various Air Pressures, p lbs. per sq. ft.							
Inches	p = 5	p = 8	p = 10	p = 15	p = 20	p = 25	p = 50	p = 100
			For Rib Spacing a = 12″				t = p/8c	
0.1	6.25	10.0	12.50	18.75	25.0	31.25	62.50	125.0
0.2	3.12	5.0	6.25	9.37	12.5	15.62	31.25	62.5
0.3	2.08	3.33	4.16	6.25	8.33	10.41	20.83	41.66
0.4	1.56	2.5	3.12	4.68	6.25	7.81	15.62	31.25
0.5	1.25	2.0	2.50	3.75	5.00	6.25	12.50	25.0
			For Rib Spacing a = 13″				t = .1465 p/c	
0.1	7.32	11.72	14.65	22.0	29.30	36.60	73.25	146.5
0.2	3.66	5.86	7.32	11.0	14.65	18.30	36.62	73.25
0.3	2.44	3.91	4.88	7.33	9.76	12.20	24.41	48.8
0.4	1.83	2.93	3.66	5.5	7.32	9.15	18.31	36.6
0.5	1.46	2.34	2.93	4.4	5.86	7.32	14.65	29.3
			For Rib Spacing a = 14″				t = .1701 p/c	
0.1	8.50	13.61	17.01	25.51	34.02	42.52	85.05	170.1
0.2	4.25	6.80	8.50	12.75	17.01	21.26	42.52	85.0
0.3	2.83	4.53	5.67	8.50	11.34	14.17	28.35	56.7
0.4	2.12	3.40	4.25	6.37	8.50	10.63	21.26	42.52
0.5	1.70	2.72	3.40	5.10	6.80	8.50	17.01	34.0
			For Rib Spacing a = 15″				t = .1953 p/c	
0.21	9.76	15.62	19.53	29.29	39.06	48.82	97.65	195.3
0.	4.88	7.81	9.76	14.64	19.53	24.41	48.82	97.6
0.3	3.25	5.20	6.51	9.76	13.02	16.27	32.55	65.1
0.4	2.44	3.90	4.88	7.32	9.76	12.20	24.41	48 8
0.5	1.95	3.12	3.90	5.85	7.81	9.76	19.53	39.0

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* Tech. Report, Brit. Adv. Com. Aeron. 1912-13, p. 232.

THE REMARKABLE PERFORMANCE OF JL-6 MONOPLANES ON TRANS-CONTINENTAL TRIP

ONE of the most remarkable performances in the history of flying in the United States was completed on August 22 when a JL-6 all-metal monoplane landed at Central Park, Long Island, after a round-trip trans-continental flight. Five men were in the aerial limousine—the first five ever to fly across the country and back in the same aeroplane. They were E. E. Allyne, of Cleveland; Capt. E. V. Rickenbacker, and John M. Larsen, a pilot and a mechanician.

The route covered flying to the Pacific Coast was as follows: Starting from the Larsen Airdrome, Central Park, Long Island, to Cleveland, Chicago, Omaha, North Platte, Cheyenne, Wyo., Salt Lake City, Reno, San Francisco, Los Angeles, Tucson, Ariz., El Paso, Roswell, New Mex., Amarillo, Texas, Kansas City, Chicago, Cleveland, Bellefonte, Pa., back to aerodrome in Long Island.

The plane that completed the round-trip trans-continental flight was the only one of the Larsen aeroplanes scheduled to return to New York. The other Larsen monoplane that left Central Park, July 29, on the air mail trail-blazing flight to the Pacific was being "ferried" to the Mercury Aviation Company at Los Angeles.

John M. Larsen, owner of the all-metal ships, was host on the flight and originator of the plan for the record-breaking performance. The trip has given great impetus to commercial aviation.

One of the chief missions of the expedition was to locate inadequate landing fields at trans-continental air mail stopping points, and to bring about the establishment of suitable fields. Defects and the way to remedy them were pointed out to local officials.

"You have started everybody here working on the job," is the tenor of letters now being received from cities where missionary work was done.

Some 8,000 miles were flown on the trip, considerable of this distance, of course, being covered in "hops" for officials and others interested in aeronautics at the numerous stopping places. The actual flying time was close to 60 hours.

All along the route a wonderful reception was given the aerial voyagers at each stopping place. Cheers and bands featured many a landing. In Oakland floral bombardments by pretty girls proved a novel feature of aeroplaning. The throng of more than 10,000 that greeted the flyers there was typical of the warmth with which California, especially, welcomed the all-metal monoplanes which heralded the early arrival of mail by air.

The northern route was followed on the outward journey. The return trip, started from Los Angeles, August 14, took the plane across the Rockies by the southern route. Stopping places were Tucson, Ariz.; El Paso, Texas; Amarilla, Texas; Roswell, New Mex.; Kansas City, Mo.; Chicago, Ill.; Cleveland, Ohio, and Bellefonte, Pa. The latter place was reached August 19. Heavy haze and rain delayed the party's start on the remaining short leg until August 22. Then the plane took off in very hazy weather and flew home through a rain storm that sent the water pouring in floods from the trailing edge of the wings.

The imperative necessity for more and better landing fields to make trans-continental aviation more feasible commercially was the outstanding lesson taught by the flight, according to Major L. B. Lent, General Superintendent of the U. S. Air Mail Service, who acted as navigating officer of the plane delivered at Los Angeles as far as that city.

Major Lent obtained valuable data for the opening of the cross-country aerial mail route, that may be made public later.

"There were no 'adventures' and no 'thrills' on the trip," declared Capt. Rickenbacker. "Our journey was as safe as if made in a Pullman. It proves—if proof is needed—the wonderful worth and reliability of the JL-6. The engine was running as smoothly when we landed as when we left, and this after approximately eighty hours in the air."

Even while crossing the Rockies the trip was as smooth and easy as a ride along Fifth Avenue in an auto. It was on the route from Cheyenne to Salt Lake City that the highest altitude of the journey—22,000 feet—was reached.

"The air was bumpy, but we were doing 140 to 145 miles an hour, so we speedily got out of the uneven air currents," said Mr. Allyne, speaking of the trip.

The Cleveland manufacturer, an enthusiastic convert to the all-metal monoplane, was aboard a train bound homeward one hour after landing at Central Park.

"Seems rather old-fashioned, traveling a paltry 50 miles an hour by train after making 150 mile speed in an air limousine," declared Mr. Allyne, laughingly, as he sped from the Larsen flying field by auto.

In round figures, the trans-continental plane averaged 8 to 9 gallons an hour of fuel on the trip. Oil used averaged one-third of a gallon an hour.

Of the landing fields used, those at Cheyenne and North Platte were the best and the field at Tucson, Arizona, is also good. The fields at Reno and Salt Lake City share, at present, in the tail-end honors. The officials of both cities, however, are willing and eager to make the landing fields such as the air mail service needs. Salt Like City probably will use a new tract of land. Reno is ready to perform wonders for a small city.

One result of the trail-blazing trip will be the speedy establishment of adequate landing fields not only at the air mail route's regular stops, but also at emergency stops in between the regular stations. Hangars, also, will be erected where necessary.

It seems probable that, for some time at least, the mail plane halt at the westward end of the route will be Durant Field at Oakland.

Mr. Larsen, who has flown some 15,000 miles in the last three months here, in addition to having flown many thousands of miles in Europe, is of the opinion that the northern route over the Rockies will be a difficult one to maintain during the Winter months, when heavy snow storms and extreme cold will be encountered. He thinks it will be advisable to carry the air mail over the southern route during the Winter months.

Major Lent, who came from the air mail terminus at Hazelhurst Field to Central Park to greet the incoming flyers, said to Mr. Larsen:

"It was a privilege and a pleasure to ride in and navigate one of the ships which made the trans-continental trip from coast to coast and on from San Francisco to Los Angeles. The completion of such a trip with so large a number of passengers and so much baggage without accident of any kind or delay, was a remarkable and unique experience for me, and, I believe, for commercial aviation in this country.

"The performance of the plane on its entire journey was a real revelation. I was sorry not to be able to accompany you on your return trip, which was successfully ended to-day. I extend my hearty congratulations on the completion of your mission; for I feel that in delivering one ship to the Pacific Coast, and in making the round trip in the other, without making a most careful and complete preparation, is conclusive evidence of the wonderful performance of your ships, not to mention the fine performances of your pilots.

"I trust you will accept my best wishes for all the success which can come to one who has done so much for the development of commercial aviation."

Police in Aeroplane Spy on Crap Games

Pittsburgh.—Because of the failure of the police to break up crap games for high stakes played every Sunday on a high, thickly wooded ridge in Penn Township, the county officials have engaged an aviator to fly over the section where the big games are run and after locating the players swoop down on them.

Owing to the topography of the country near Lincoln Avenue the gamesters, aided by lookouts, have been able to frustrate efforts to break up the games. Lookouts with powerful glasses spot the detectives a mile off, and the crap shooters are mere picnickers when the detectives reach them.

Relation of Rib Spacing to Stress in Wing Planes

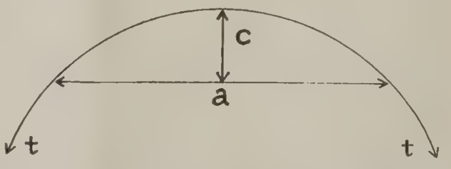
(*Continued from page* 19)

pressure, rib spacing, and depth of bulge; and if r be the radius of curvature of the bulging fabric, assumed to be circular, as in the sketch; the following relations obviously obtain:

$$t = pr,$$

$$a^2 = 4c.(2r-c),$$

$$\therefore\ t = \frac{pa^2}{8c}\left(1 + 4 + \frac{c^2}{a^2}\right).$$



The first of these comes from equating the up lift of the air to the down pull of the tension; the second from equating the square of the chord to four times the product of the segments of a normal diameter. The derived equation shows that if $c/a = 1/20$, $t = pa^2/8c$, accurately to one per cent. In taut fabrics c/a may equal 1/20, or thereabouts, under full load.

NAVAL and MILITARY AERONAUTICS

Army Air Service Changes

Changes in the organization of the Army Air Service and the assignment of functions to groups and divisions were discussed at a conference of group and division chiefs held on Aug. 26 at the office of Major Gen. Charles T. Menoher, U. S. A., Chief of the Air Service. Final determination was made of matters relating to funds, personnel, office space, etc., and plans approved which will insure the harmonious working out of all the details involved in the changes of organization required under the Army Reorganization act. It was decided that the information group, in addition to its present duties, will have jurisdiction over foreign Air attachés. In addition to its other functions the engineering division of the supply group is charged with all matters connected with the production, inspection and purchase of aeroplanes, engines and all technical accessories that are not standard articles of manufacture; the keeping of statistical records of all factories that are equipped to fabricate aeroplanes, engines and technical accessories and all necessary raw material; the development of means of improving the proper and economial operation of all heavier-than-air equipment; the prescription of Air Service stations, of uniform and proper methods for the mechanical operation, repair, care, storage, handling and packing of heavier-than-air equipment; the correction of weaknesses or defects in design of material or equipment in service; the thorough investigation of all crashes due to mechanical or structural weaknesses and the provision of means to prevent their recurrence; the preparation of specifications for all Air Service material and equipment; the preparation of an operation manual for each new type of equipment placed in operation by the Air Service; the preparation of illustrated parts lists and drawings for the Air Service; the standardization of the sizes of specifications, drawings and spare parts lists. In the property division, the engine and plane maintenance section is abolished. In addition to its other duties the division is charged with the storage and distribution of all heavier-than-air equipment; the reporting of weaknesses in design of material; the testing of fuel and lubricants; operation of Air Service repair depots or other activities engaged in the maintenance of equipment; recommendations concerning the technical educational qualifications of engineer officers and the standard of training of enlisted mechanical personnel, and the operation of a stockkeeper's school as one of the Air Service special service schools. The functions of the procurement division are amended so as to relieve it of all functions connected with the production, inspection and purchase of aeroplanes, engines and technical accessories. The training and operations group is charged, in general, with all training and instruction in the Air Service, its operation, which includes the preparation of all war plans for the Air Service, and with the choice of means of carrying out such training and operation.

Army Alaska Planes Start for New York

Nome, Alaska.—Three of the four aeroplanes in the United States army's Alaska aerial expedition took the air on the return flight to Mineola, N. Y., on August 25. The first leg of their trip will take them to Ruby, three hundred miles east. Captain St. Clair Street, commander of the expedition, expected to hop off the following day.

Atlantic Fleet Torpedoplane Division

Activities of the U. S. Atlantic Fleet Torpedoplane Division are to include a test of the Navy Martin bombing and torpedoplane on a field set apart for this purpose at Yorktown, Va. Lieuts. H. J. Brow, G. C. Miller and T. N. Thweatt, U. S. N., who have reported to the Director of Naval Aviation, have been assigned to duty qualifying in these new aircraft. They have been making flights in the vicinity of Washington from the Navy aviation station at Anacostia, D. C. If the field proves satisfactory, operations in torpedo and bomb dropping will be begun at Yorktown as soon as hangars and other buildings now under construction are available. The establishment and maintenance of this base will cost approximately $35,000, according to data submitted by Lieut. Comdr. Harold T. Bartlett, U. S. N., in charge of administration at the Naval Air Station, Pensacola, Fla.

Army Air Service Engineering School

The Army Air Service Engineering School, established at McCook Field, Dayton, Ohio, will begin its second year on Nov. 1. It will have a student body of twenty officers, especially selected on recommendation of the different commanding officers of the Air Service, which recommendations must be in the hands of the Chief of Air Service not later than Sept. 15. This is one of the special service schools of the Air Service intended to furnish a higher course of study in technical, mechanical and supply features peculiar to the Air Service for those Air Service officers who show special aptitude for this duty. The graduates are to form a nuceleus of officers suitable to handle efficiently the problems of technical equipment and technical control in the Air Service. The engineering studies prescribed in the curriculum must not be confused with the general engineering education given all officers of the Air Service in supply and technical equipment at various other primary special schools and at the Air Service Field Officers' School, Langley Field, all of which activities include a certain amount of such training. The staff at the Dayton school consists of a commandant, an executive officer and an officer in charge of instruction, together with such other officers detailed for instruction in connection with other duties at McCook Field. An outline of the course of instruction may be obtained on application to the commandant of the school.

Air Service Maintenance Funds

Commanding officers of all Army Air Service activities have been instructed by the Chief of Air Service that the Secretary of War has made an apportionment from Air Service appropriations to the Quartermaster General for the purpose of maintaining buildings and grounds and the operation of utilities at Air Service stations. The Chief of Air Service calls attention to the fact that maintenance is a function of the Q. M. Corps, Construction Service, except at McCook Field, Dayton, Ohio, and that his office has no power to act upon requests for funds or the employment of personnel in matters relating to these functions. Such requests are to me made to department utilities officers. Commanding officers desiring action taken looking toward the construction of new buildings or improvements of existing structures are to make recommendations to the office of the Chief of Air Service through proper channels. The Quartermaster General has informed the Chief of Air Service that only a small part of the apportionment from Air Service appropriations has been set aside for the necessary minor improvements at Air Service stations.

Developing Parachute Navigation

In training men to drop from aeroplanes with the U. S. Army type A parachute it has developed that forty out of forty-two jumpers who were interrogated on the point did not experience a sensation of falling, but rather of continuing with the plane. Tests have also developed the possibilities of navigation with the parachute. For example, oscillation is overcome by using the same tactics as in a swing; a sideslip is negotiated in any direction by simply pulling down on one set of cords so as to avoid unfavorable landing places; on nearing the ground a reserve parachute is released solely for relieving the jumper of its weight in landing. This parachute does not always open, but in many instances it opens fully in time to make landing easy, in fact many jumpers retain their feet. With the development of the seat pack on which the flier sits for a cushion, allowing him free action, the parachute is regarded as deserving the name of the life preserver of the air.

Rich Field to be Abandoned

Recent activities at Rich Field have afforded a marked contrast to activities during the days that passed when Rich Field was active in training of cadets and the performance of those functions which characterized flying fields during the war. Orders have been received for the abandonment of the Field by October 31, 1920, and the officer personnel force and the enlisted and civilian personnel forces have been organized for expeditious service in packing and shipping materials stored at Rich Field to the various points of destination received in instructions. The De Haviland 4 planes, the Curtiss H planes and the JN 4 D's are rapidly being crated by one force; other materials of a miscellaneous nature are being crated by another force; and still another force is organized for loading the crated planes and other packed materials to be hauled away.

FOREIGN NEWS

The Halberstadt Aerodrome in Germany Sold

In heavy competition with other cities, the Halberstadt aerodrome has been chosen as the station of the Saxonian safety police flight squadron, as to this end the total works of the erstwhile Halberstadt Aircraft Manufacturing Company has been bought from the Berlin-Halberstadt Industrial Works.

Aviation in Java

The principal aerodrome is Kali Dvatch, which was originally part of the Pamanoekan en Tjiassemlanden, the Dutch holding company, all of whose shares are owned by the Anglo-Dutch. A well-known aviator in England, De Ruyter, is there. Avros with 110 Le Rhône engines and D. H. 9s with 230-B.H.P. engines are the machines at present in use; but S. E. 5s are on the way. All flying takes place before 9 a. m., as it is too bumpy and not enough lift owing to heat after that.

The aerodrome is very large and quite flat. At present the hangars are native attap-roofed huts, but permanent concrete ones are being made.

Cantilever Wing Patent Applied For

Mr. Douglas Shaw, of London, England, is the inventor of a new type of aerofoil for which protection has recently been applied for. The aerofoil is designed to be naturally stable and, while lending itself to the cantilever principle of construction, combines a high lift coefficient with a high lift/drag value. With a crude model having an aspect ratio of only 2, glides at angles in the neighborhood of 1 in 15 have already been accomplished.

A Scottish Aerial Derby

A proposal is on foot to organize a race on Aerial Derby lines over a 100-mile course, taking in Edinburgh, Glasgow and Stirling. The route proposed is a triangular one, from Turnhouse aerodrome, circling the flying ground at Renfrew, then round Stirling and back to Turnhouse. It is anticipated that there will be a good entry and further details will be awaited with interest.

France to Use Zeppelins to Relieve Traffic Congestion

Paris.—Zeppelins will be used to relieve the congestion of freight traffic on the French state railroads, according to a plan approved by the ministry of aviation. The ministry expects put half a dozen former German airships in operation within the next two months. The first Zeppelins which will be delivered to the French at Maubeuge will be used entirely for study in connection with the feasibility of constructing a reserve fleet of airships to patrol the French borders.

Manned entirely by a French crew, one airship belonging to France already has covered more than 3,000 miles without accident.

Zeppelin L-113, delivered to the French by the Germans on September 1, will be used for long voyages between Paris, Tunis, Casablanca and Dakar, transporting foodstuffs and raw materials, with which French ports are clogged, while industries are waiting to resume reconstruction work. The L-113 has a capacity of 75,000 cubic yards of gas, and is nearly 700 feet long. It is possible to operate the ship with a crew of 15, although 40 men are required to anchor her.

The government does not intend to construct intermediary hangars, but will place along the route between Paris, Casablanca and Dakar huge blocks of concrete, with iron rings attached to them, where the ship may be moored.

If the venture is successful, a private company will be authorized to construct airships. Estimates by experts are that airship transport charges will not be more than those applying on carload lost by rail, while delivery by air will be much quicker.

Aeroplane Used in Land Prospecting

Winnipeg, Man.—Aeroplanes, according to officials and business men here, seem destined to become an important factor in colonization work.

"The best way for prospective homeseekers to survey the land in western Canada open to settlement is to fly over it," said Mayor Gray of Winnipeg, who has returned from an extended trip by aeroplane over the western part of Manitoba. "It was a revelation to me to see so much land that has never been touched by a plough. I have been through that part of the province in trains and automobiles many times, but I had no idea that so much farm land as rich as any on the continent is lying idle. The agricultural resources of Manitoba have hardly been scratched. There is room for tens of thousands of additional farmers."

More Aerial Trips in England

Breakfast in London, luncheon in Paris and dinner in Amsterdam. This is the slogan of a new passenger aerial service established between London and Amsterdam by the Airco Company of London, according to advices reaching the Army Air Service. Large passenger planes on Mondays, Wednesdays and Fridays are to leave London and Amsterdam at 9.30 in the morning and 4.30 in the afternoon.

The same advices state that the Handley Page Company has again increased the number of planes operating on regular daily schedule between London and Paris.

Japan Developing Sea Island Flying

Tokio.—In order to initiate an aerial transport service to South China and the South Sea Islands, Japan probably will establish in the near future an aeronautic laboratory at Mako, in Formosa.

Capt. Satch, attached to the Formosan Government, before leaving Tokio for Nagasaki on official business, told of the excellent work being done in the Island of Formosa by the Japanese Government, particularly in connection with police work among the aborigines. Besides serving as a splendid naval base for aerial activity in the future, Capt. Satch believes that a great number of flying machines will aid the Government materially in its work with the aborigines.

In addition to the aerodrome a laboratory for aeronautic research will be established.

British Flyers Picked for Gordon Bennett Race

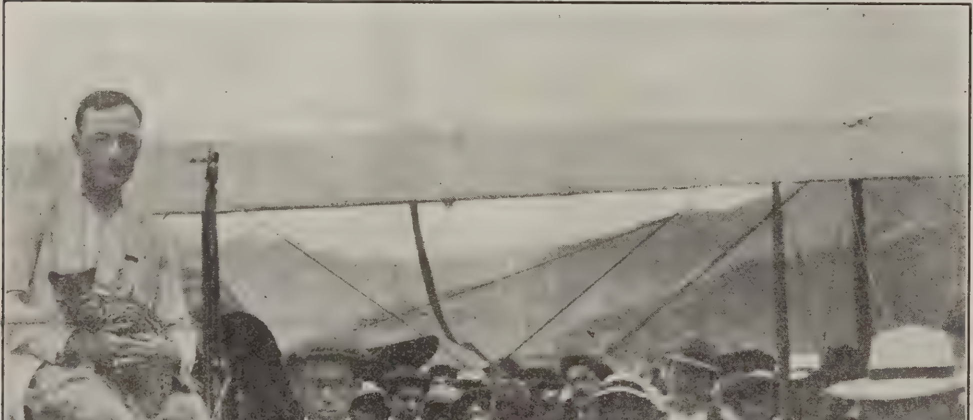
London.—Great Britain's contestants in the race for the Gordon Bennett aviation cup, which will be held at Etampes, France, on September 28, have been selected by the racing committee of the Royal Aero Club.

Harry G. Hawker and F. P. Raynham, who attempted the trans-Atlantic flight in 1919, will compete. Hawker will use a Sopwith Jupiter machine, while Raynham will have a Martinsyde Semiquaver. L. R. Tait Cox, the third entrant, will fly a Nieuport Goshawk plane.

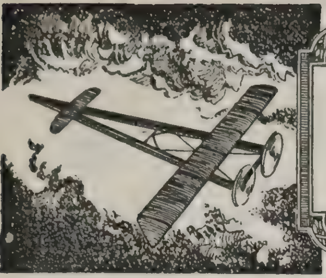
Commercial Flying Planned for India

The Handley Page Indo-Burmese Transport has been formed to undertake commercial flying in India. It expects to obtain subsidized Government contracts for aerial mails in India and Burma and to be appointed sole agent in these countries for the sale of aeroplanes, aero-engines and aircraft materials held by the Aircraft Disposal Company, Ltd., which holds the entire surplus stock of aircraft, with accessories, of the British Government.

It further proposes to undertake the transport of passengers and goods, to institute a flying school, and to repair all types of aircraft.



Knox Martin, the veteran U. S. aviator, who has been creating great interest in flying in Columbia, Central America. He is shown holding his pet tiger. Mr. Martin began flying in 1911, with the Thomas Brothers at Bath, N. Y., and during the war served as a Lieutenant in the U. S. Marine Aviation Section. He has flown on exhibition tours all over the United States, China, Japan and Australia. He has just returned from Columbia to the United States to get some aeroplanes to take back there to open a government flying school and an aerial mail service



ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

CLUBS

PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.
TRIANGLE MODEL AERO CLUB
Baltimore, Md.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.
CAPITOL MODEL AERO CLUB
1726 M Street, N. W. Washington, D. C.
AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., N. Y. City
AERO CLUB OF LANE TECHNICAL HIGH SCHOOL
Sedgwick & Division Streets, Chicago, Ill.

Heliocopters

A heliocopter is a contraption that can rise vertically and descend in the same way.

Most of them are designed with a series of propellers driven by a single engine set to lift the machine instead of pulling or pushing it.

I do not believe the study of heliocopters is too deep for even the youngest of our readers, and even now some inventors have reached a point when a certain degree of success has been realized.

The French Government recently financed an individual who worked out a clever scheme for vertical rising that looks as if it might work successfully.

Many readers have seen the heliocopters sold in toy stores that consists of a twisted flat strip of metal or some other method that resembles a screw, and a loose propeller made of metal which has a slot in the hub that allows it to be pushed on the twisted strip and allowed to go to the bottom, then the strip is held in one hand and a spool in the other that bears directly against the loose propeller. When started on its flight it is pushed off forcibly, the revolutions per minute being high, and it rises to a great height until the revolutions begin to fall off and it begins to descend slowly at first until the revolutions stop altogether, only to start again in the reverse direction which allows it to settle gradually on the ground.

All heliocopters work on the same principle, that is, the propellers, or lifting planes, are driven in one direction to lift the machine; some have the propellers reverse when descending.

On the French machine the propeller is really rotating wings which lift the machine by action of the planes being driven against the wind when rotating rather than depending on forward speed. The planes have a pronounced angle of attack near the root where they are attached to the shaft, but flatten out and gradually assume a negative angle at the tips. This arrangement exerts a lifting force while the wings are being rotated, although the tips are at a negative angle (a wing will lift at a negative angle to as much as 2° minus in some cases according to the curve used), and when the power is cut off they would continue to rotate in the same direction due to the fact that the tips would glide "down hill" as it were and the inside portion of the wings would be lifting and breaking the rapid descent of the machine.

I would like to see some of the advanced model readers become interested in this type of machine, as I believe the time is not far away when the heliocopter will have become so successful that flights of long distances can be undertaken with safety.

As a suggested model I would advise a stick of spruce ¼" x ⅜" and say 24 inches in length which would be the motor stick. At the end a combination of gears should be worked out where two shafts, one rotating inside the other, could be used. One shaft to turn to the right, the other to the left. Instead of propellers four planes built up of light material and so arranged that they could be separated in the center, and connected by a brass sleeve which would act as the hub and be a fastening for the wings besides. With the sleeve one wing could be set at an angle to the other like the blades of a propeller.

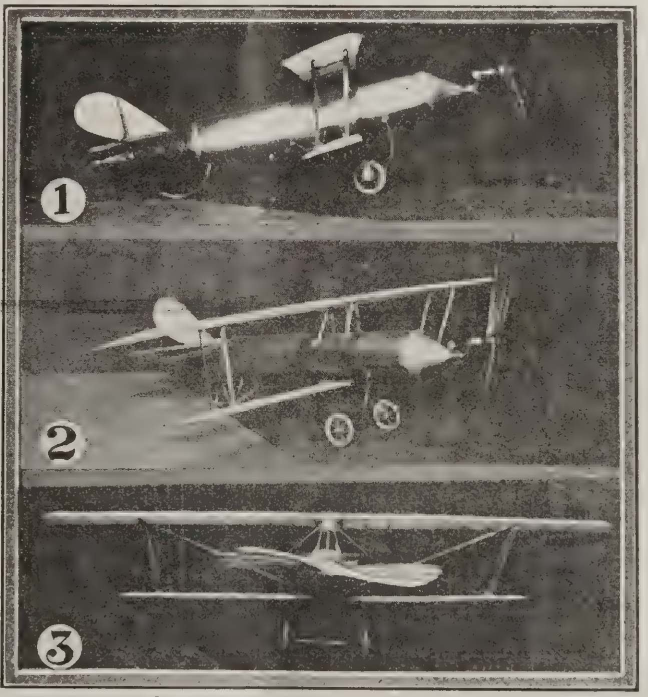
When setting the angle of the wings be careful to have both the same and fastened so they cannot change when rotating.

The planes are set one above the other, that is, one pair is on top turning in one direction, the other is below turning in the reverse direction. It may be necessary to give the lower ones a different angle of attack on account of the pressure from the top wing blowing down on the lower one.

When wings are made and everything is ready, the tips of the wings, or say the outer half, should be steamed over the spout of a kettle and bent so that they have a negative angle of attack. Be sure to have each side the same. Another good thing to do would be to have the gearing so arranged that the planes could rotate of their own accord when the power was consumed and the rubber motor had wound itself out. This would allow the machine to glide back slowly to the ground.

For forward travel a tractor screw could be fastened on that would propel the model forward, but for experimental purposes this is not necessary.

Many interesting things can be learned from a model as above and I would like to see some photos of model made as outlined.



The above cut shows a very unique and interesting compressed air motored model in which the body is formed by the tank. It is the work of A. C. Welke, Milwaukee, Wis.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Why Not An Aeroplane?

At the local club they were comparing notes as to the speed and other qualities of their cars, when Stevenson remarked:

"That man Smythe, who has a suburban real estate development, has the fastest car in this part of the country. He makes seventy miles an hour."

"Great Scott!" exclaimed a listener. "What does he want a car like that for?"

"He's got to have it when he's advertising his property as being five minutes from the station!"

Wives—Take Notice

DOCTOR—"You said you were hit with a flatiron. You do seem to be suffering from shock."

PATIENT—"Yes; it was an *electric iron!*"

1924

An aerial cop went up for a hop
To pinch a speeding flivver;
But his old plane flopped when the motor stopped
And away buzzed the naughty flivver.

—*Naval Air Current.*

So That's Why We "Boil"

"What is steam?"

"Water in a high state of perspiration."

DARE DEVIL DICK—No. 1. When the Mail Plane Fouled His Kite String

YOU-DICK - COME RIGHT BACK HERE WITH THAT CLOTHES LINE - OR I'LL WHIP YOU GOOD - TH' IDEA OF USIN' MY WASH LINE FOR YOUR OL' KITE TAIL !!!

Courtesy Fly Leaf

Wireless Wanderings

Flat on his back an indolent philosopher held forth on the joys of "wireless travel," as he called it.

"We have been reading about the yacht races reported by wireless telephone. Then comes a successful experiment with transmission of pictures by wireless. Next we will have the wireless movie.

"When that time comes I shall be able to enjoy my penchant for foreign travel without the suffering of seasickness.

"I'll hire a movie aeroplane equipped with a wireless motion picture transmitter and start the flyer on his way. I'll lie here on my back and watch the panorama of the earth unfold on a screen mounted on the ceiling.

"When the aeroplane passes over a place that looks interesting I'll signal for the aviator to descend and get close-ups with the wireless movie machine, and start the wireless telephone to working so that I can hear what is going on."

Whether philosophers are optimistic depends on the philosophers. The indolent variety usually are. But even granting the optimism, the forecast is not so impossible as it may sound.

Grandparents of the present generation who might have dared to indulge in speculations on flying, wireless telephony and wireless telephotography would have been considered insane.—*N. Y. Evening World.*

Some Clock

"Do you mean to tell me that clock will run eight days without winding?"

"Yes."

"Well, then how long will it run if you wind it?"—*Martin F. Keane.*

"Applied" Astronomy

She—There goes a shooting star.

He—You know that when a girl says she sees a shooting star it means she wants to be kissed.

She—There goes a constellation.

(Note: Great flocks of pelicans are seen flying around the bay.)

In fleets the Pelicans are flying,
In a formation that surely excels
Those comical, clumsy seaplanes
Known as the F-5-L's.

—*Naval Air Current.*

So Say the Air Service Squadrons

ORATOR: "The League of Nations means disarmament for the world. It means that the weapons of war will be thrown away for all time!"

From the rear piped up O'Brien, of the Engineers: "Bedad, and I'm for it. I niver want to lay eyes on a shovel again."

—*The Red Diamond.*

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New York to Helena, Arkansas, 14 hrs. 40 min., flying time

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New York to Minneapolis, Minn., 16 1-2 hrs., flying time

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1. FIRE AND TRANSPORTATION.
2. THEFT (of the machine or any of its parts).
3. COLLISION (Damage sustained to the plane itself).
4. PROPERTY DAMAGE (Damage to the property of others).

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STRENGTH REPUTATION SERVICE

(*Continued from page 6*)

bankrupt the Aero Club of America to assume, and would place the Aero Club of America at the mercy and under the control of the Manufacturers Aircraft Association, which has been condemned by the United States Senate Investigating Committee as **"vicious and designed to reap large profits by taking advantage of the necessities of the Government"**; and further attempts to convey the impression that the Manufacturers Aircraft Association represents the four hundred, approximately, commercial organizations which constitute the American aircraft industry, whereas as a matter of fact the Manufacturers Aircraft Association includes but a small number of the active commercial aeronautic organizations which constitute the aircraft industry.

Aircraft Firms Refuse to Join Manufacturers Aircraft Association

That the other organizations totally disapprove and condemn the vicious methods of the Association and refuse to become members of it, and many of them are waiting for the U. S. Attorney General to institute investigations of the Association as authorized by Congressional resolutions of April, 1920, so as to present evidence that the said Association has been guilty of unlawful conspiracies, trade restraint practices, misrepresentations and concealment of facts and pernicious lobbying for the purpose of creating the impression that members of the said Association were in need of and should be given unwarranted government subsidies; and that by unlawful methods and expenditure of funds which the said Association obtained from Government Departments under misrepresentations, agents of the Association have sought and still are seeking to influence national legislation aiming to give the Association control of the aeronautic industry and of the Aeronautic Art and Science, the progress of which they are attempting to limit and demar its scope to the extent to which they can control it for their own selfish interests and profit.

Mr. Woodhouse Urged Repeatedly Consideration of Facts

That before instituting this said action deponent submitted to these individual defendants a broad and equitable basis for consideration of the subject from the standpoint of safeguarding the financial interests, the honor and standing of the Aero Club of America in dealing with both the situation created by the forthcoming investigations by the United States Attorney General, of the Manufacturers Aircraft Association, and the Aero Club of America's policy toward same; as well as the policy to be adopted by the said Aero Club of America toward these members of the American Flying Club who are NOT under Government investigation or connected with conspiracies to defeat the ends of justice, **but defendants refused to consider this fair and equitable basis and further, by misrepresentations, intrigue and suppression of facts and of documents, prevented consideration of this fair, broad and equitable basis of consideration.**

Defendants Suppressed Requests for Consideration of Policy To Be Adopted By Club in Government Investigations

Regarding the policy and attitude to be maintained by the said Aero Club of America toward the Manufacturers Aircraft Association and any other organization or individual condemned by Government authorities for unlawful activities against the United States and about to be investigated by the U. S. Attorney General and Federal Grand Juries, under date of April 28, 1920, deponent submitted in writing to the Board of Governors of the Club the following statement of the situation, which was promptly suppressed by these said defendants, who prevented its being considered by the said Board of Governors of said Aero Club of America, to wit.:

"It is proposed that the Club become affiliated with the very interests that are accused of being responsible for the scandals reported by Congress.

"The Board of Governors must decide which of the following alternatives it wishes to adopt.

"1. Whether to join the prosecution and assist the Attorney General in his task of getting refunds from the manufacturers who have illegally or fraudulently obtained moneys and punish those who are responsible for the crimes reported by Congress.

"2. Whether to remain netural and assume the position of a jury, or judge, giving only an opinion if asked.

"3. Whether to join the defense and let those accused of the evils referred to, use the Club as a shield to help defeat the purposes of justice. (This is only stated to explain the situation clearly and completely.)

"It is obvious that from a patriotic and ethical standpoint, an organization like the Aero Club of America, which conducted the campaign for large appropriations for national defense, has a solemn, moral obligation to assist the Government in every way.

"If the Board does not feel that it should assist actively in the task of bringing the guilty ones to justice, then it is obvious that the only position compatible with our position is to remain neutral.

"We cannot negotiate with the people who are trying to get in the Club at persent without breaking faith with the Ameircan public, without staining the Club's good name, without sacrificing the Club's liberties, ending its usefulness as a moral force and becoming identified with the aircraft scandals and assuming responsibility in connection with crimes committed by individuals of apparently low moral standard.

"In view of the facts I believe that the Club should not take any steps which may be interpreted as negotiations with the individuals accused by the Government, nor give any openings to those individuals to use the Club as a shield or to make it appear, as they have during the past two weeks, that they are to be taken into the Club.

"Very sincerely yours,

(Signed) "HENRY WOODHOUSE."

The minutes of that meeting show that the Chairman of the so-called "Co-operating Committee," Charles L. Poor, one of the defendants in this action, moved that deponent's said letter be referred to his Committee and that he took the letter. There is no record of any report having been made or any actions having been taken on the important issues explained in this said letter.

Request to Have Matter Submitted to Club Membership for Vote Disregarded

Deponent and many other officers and members of the said Aero Club of America in good standing and the "Committee to Safeguard the Financial, Legal and Moral Rights of the Members of the Aero Club of America" hold that the only fair, equitable and just way of deciding this very important and far-reaching series of questions is to submit such matters to the *entire* membership of said Club in writing, in the form of a referendum, so that any action on this matter will be based on a definite policy approved by the majority of the members of the Aero Club of America after full discussion and knowledge of all the facts.

Such a policy is not only, it is submitted, sane, ethical and business like, but appeals to the good conscience and judgment of all those who really and sincerely and honestly have the best interests and welfare of the said Aero Club of America at heart. Deponent was assured repeatedly of contracts worth "thousands of dollars" for advertising in his publications if he would but sanction the plan urged by these three defendants and give his approbation to the wicked scheme of subjecting the GREAT Aero Club of America to the wholly selfish and base influence and designs of the said Manufacturers Aircraft Association.

The heart sickens in contemplation of a possible consummation of such conspiracies and schemes; and deponent could not and would not (even though it spells absolute financial ruin for him) stand supinely by and permit such outrages to be perpetrated, and will continue to oppose such intrigues to the very end, let the cost be what it may.

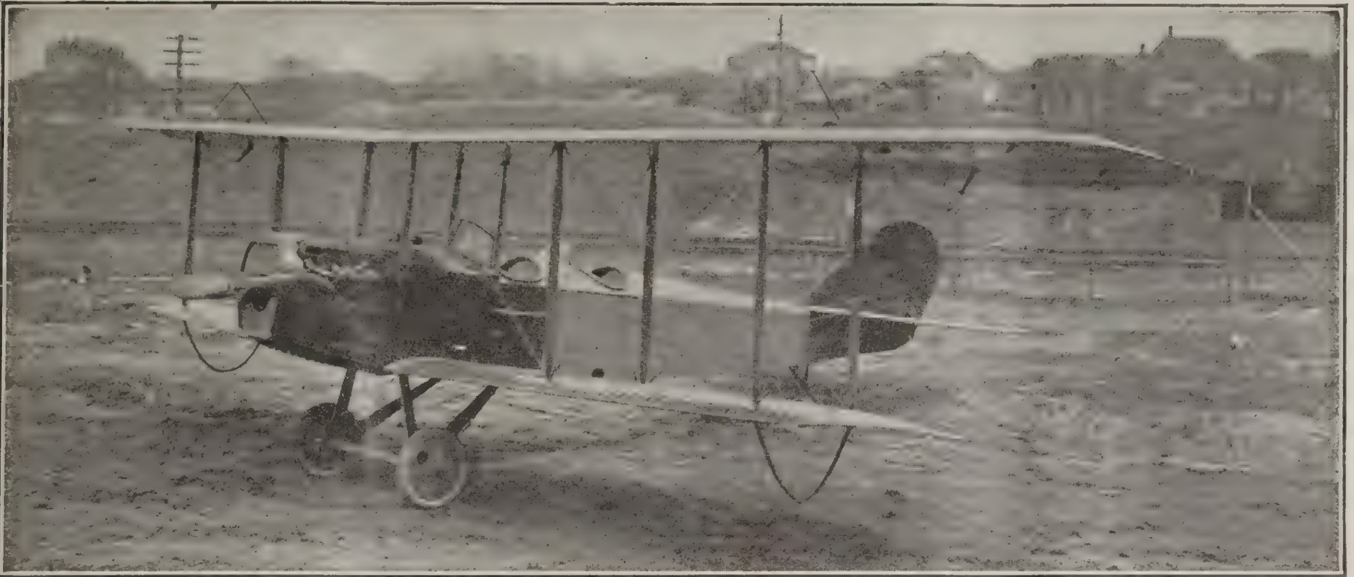
The efforts made by plaintiff from time to time and continuously during the past seven or eight years in behalf of the Aero Club of America have been enormous and burdensome both physically and financially (that such efforts were appreciated by his fellow workers is indicated by resolutions of the Board of Governors and part of the permanent records of said Aero Club of America, excerpts from which are annexed hereto as Exhibits herein).

Clearly deponents' contentions and allegations are not far-fetched or imaginative, but facts, actual and concrete; and deponent respectfully, sincerely and earnestly urges that the Court grant the relief prayed for and prevent said defendants and their confederates from perfecting their nefarious schemes, thereby ruining the Aero Club of America as an independent organization of great moral weight, destroying its vast and beneficial influence and prestige and subjecting it to the control of such an organization as the said Manufacturers Aircraft Association.

(Signed) HENRY WOODHOUSE.

Sworn to before me this 2d day of August, 1920.

(Signed) Daniel F. Nugent, Notary Public, Queens Co. 907.
Certificate filed New York County No. 49.



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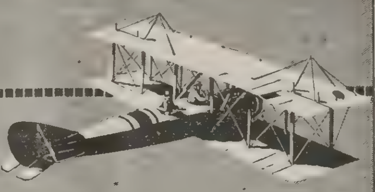

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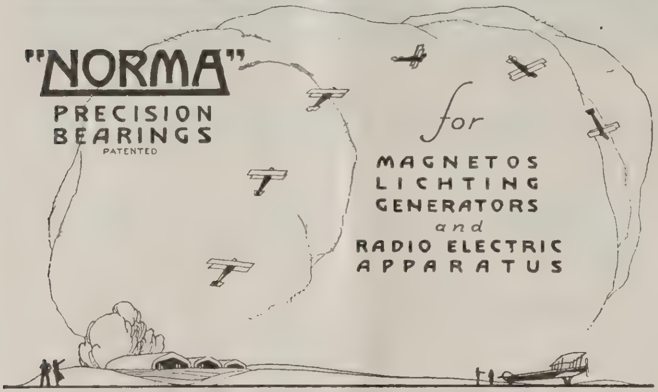

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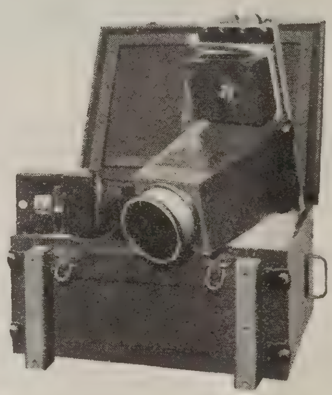

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TELE. FLATBUSH 1167

(*Continued from page 13*)

sloping (1 in 25) grain, that others are not influenced appreciably until the slope becomes 1 in 15 or greater. In general, the decrease is gradual until a slope of from 1 in 20 to 1 in 15 is reached. In this zone there is appreciable change in the slope of the curves and the rate of decrease becomes much more rapid. Sloping grain affects the modulus of elasticity least and the work and impact properties most. Hence, in material ofr slender struts, sloping grain is not nearly as important as in members subject to severe shock and vibration. For most types of aeroplane construction it may be stated that when the absolute slope exceeds 1 in 30 the design must be changed to allow for the decrease in the ultimate stresses, and in no case should material be used in which the absolute slope is greater than 1 in 15. This ruling applies to higher stressed members.

It is suggested that spiral or diagonal-grained stock can be effectively used in the webs of built-up spars, or as the center lamination of a strut built up with three laminations.

Few data are available on the effect of sloping grain on the strength properties of woods other than spruce, ash and Douglas fir, and until such data are available the percentage of reduction obtained by tests on spruce and Douglas fir should be used. Recent tests on ash show that the effect of sloping grain is nearly the same as with spruce or Douglas fir.

TABLE 3.

Ratios of Strength Values of Spiral and Diagonal to Straight Grained Material

Slope of Grain	Static Bending								Impact Bending	
	Fiber Stress at Elastic Limit*		Modulus of Rupture*		Modulus of Elasticity*		Work to Maximum Load*		Maximum Drop*	
SITKA SPRUCE Absolute Slope Classification										
**1:40 or less	100.0	88.2	100.0	89.4	100.0	92.3	100.0	75.0	100.0	76.2
1:25	97.8	87.4	98.4	88.2	97.6	90.5	86.0	65.6	92.1	70.6
1:20	97.0	87.0	96.2	85.9	96.1	88.6	78.9	57.8	87.3	68.2
1:15	96.3	86.7	92.1	81.2	93.0	85.2	67.2	46.8	77.8	57.1
1:12.5	94.4	84.8	88.7	77.5	90.7	82.6	56.2	39.8	67.4	48.4
1:10	89.6	79.6	83.0	72.0	86.8	78.5	45.3	32.0	55.5	39.7
1:7.5	81.8	70.7	72.4	60.8	78.8	70.8	34.4	24.2	43.6	30.9
1:5	66.2	55.9	55.8	45.4	64.4	55.2	24.2	15.6	30.9	22.2
DOUGLAS FIR Absolute Slope Classification										
1:40 or less	100.0	88.3	100.0	89.0	100.0	87.9	100.0	80.2	100.0	87.6
1:25	96.4	83.7	93.0	83.6	96.2	85.7	83.4	66.2	99.0	84.1
1:20	93.2	80.4	89.6	78.4	94.2	83.9	76.1	57.9	95.5	81.1
1:15	88.1	74.7	84.8	70.8	91.5	80.9	66.2	48.0	87.1	72.6
1:12.5	83.9	70.7	81.8	65.9	89.6	78.1	60.4	42.2	79.6	64.7
1:10	77.9	65.3	75.4	59.2	86.4	74.2	53.8	35.6	69.2	53.2
1:7.5	69.2	56.6	64.6	50.6	79.4	66.2	44.7	28.9	51.8	38.3
1:5	54.3	44.6	46.0	41.2	59.6	49.0	32.3	21.5	35.3	21.9

*The values in the first column under each property are the ratios of the average of the spiral or diagonal grained material to the average for straight grained material, expressed in per cent. The values in the second column under each property are the ratios of the "most probable value below mean" of the spiral or diagonal grained material to the average for straight grained material expressed in per cent. "The most probable value below the mean" corresponds closely with the arithmetical average of all the specimens having properties lower than the average properties of all the specimens. It is an indication of the reliability or variability of spiral and diagonal grained stock.

**All wood having a slope of grain of 1 to 40 or less was considered as straight grained.

(*To be concluded*)

UNIVERSITY OF ILLINOIS
SEP 22 1920

AERIAL AGE WEEKLY

ol. 12, No. 2 SEPTEMBER 20, 1920 10 CENTS A COPY

Two Years Ago Aerial Mail Was Only a Possibility, and the Only Aeroplanes Available Could Barely Carry 200 Pounds of Mail. Now the Transcontinental Aerial Mail is in Operation, the Planes Carrying Over One Thousand Pounds of Mail Each.

Why Not Be a Vanderbilt, an Edison, a Harriman or a Ford of the Air

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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The RUGGLES ORIENTATOR

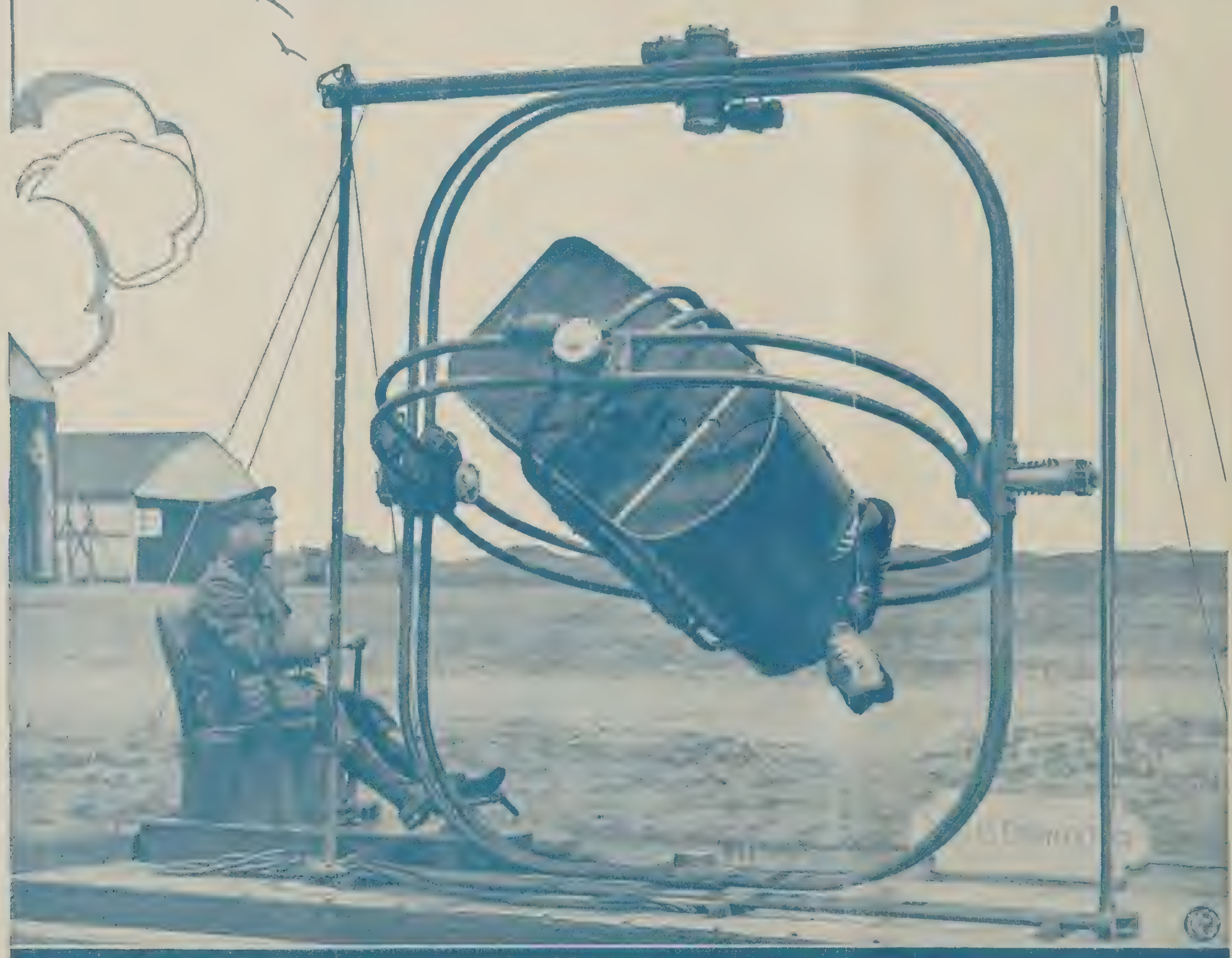
is now installed at the

Curtiss Flying Station

Atlantic City

Every useful facility, premier instructors, splendid ships and an ideal living and working environment render the **Curtiss Flying Station**, Atlantic City, the school par excellence for those students who desire to fly with superlative skill. Facilities and equipment especially desirable for the comfort and convenience of ladies is provided. Telegraph for your reservation.

Other establishments installing **Ruggles Service** will be announced.



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VOL XII. NEW YORK, SEPTEMBER 20, 1920 No. 2

WHY NOT BE A VANDERBILT, AN EDISON, A HARRIMAN, OR A FORD OF THE AIR?

THE Aerial League of America in its splendid national campaign, to establish a section of the League in every community, so as to popularize aeronautics and especially to support the extension of aerial mail service, points out the unlimited opportunities open to those who become connected with the aeronautic movement in this pioneer stage, when it is beginning to extend its usefulness to every branch of human endeavor, and the tremendous strides forward of aeronautics open exceptional possibilities for the employment of ingenuity, genius and skill and business opportunities as great as were opened by the railroad, automobile and telegraph industries.

And there are problems of engineering as huge as were solved by the world's master builders; juridical questions to be decided as stupendously difficult as a statesman ever was called upon to settle; possibilities for the development of international relations greater than were ever conceived; problems of transportation to be solved by the application of aircraft as complex as have ever confronted economists; opportunities to gain distinction dazzling enough to satisfy the most ambitious.

No other branch of human endeavor affords such splendid opportunities to men—and women, too!—as the Aeronautic Movement affords in this pioneer, ground floor stage.

Civilization stands on Man's progress, and progress depends on Man's nobler deeds. The greatest of Man's achievements are those which improve life and conquer time and space.

What Would the Great Men of the Ages Do?

What would those great Makers of History do if they could return to earth today and theirs were the privilege to select the highest task to do as their life's work?

What would the great men of the ages do—they whom we knew as builders of empires, the great leaders of Civilization, and those creative men who led the way?

They have been dead long, they could review the past and find that Achievements have lived while all that was about them then has died and is forgotten, as most things are in time.

They have been dead long—if they but could return, and with the wisdom which time gives, and with knowledge of ultimate values—what would they want to do as their life's work?

Achievements live and survive the Ages, while all else—yes, even Romance, Beauty, Music, Pleasure, Sorrow—disappear and leave no records on the sands of Time.

It is true that Beauty, Music and Romance have been inspiring factors in Man's Life, but Civilization stands on Progress—and Progress depends on Man's achievements.

What Would Columbus, Newton, Cecil Rhodes, and Lewis and Clark Do?

Would not great Cecil Rhodes who dying said: "So much to do—so little done", rejoice over the Cairo to Cape aeroplane flight and want airlines to link South Africa Cape with the world?

Would not Columbus stand in wonderment to see the great Atlantic by flights crossed—would he not cheer for Alcock, Brown and Read and want to pilot an airship and fly across the ocean in a day?

Would not great Newton stand amazed to see a five ton aeroplane rise in the air in defiance of gravity's stern laws? Would he not want to ply himself to build aircraft?

Would not Alexander the Great, of old, who cried that there was nothing more to conquer, marvel at Peary's plans for air control—would he not seek to conquer the Empire of the Air?

And would not Lewis and Clark who were first to cross the American continent, want to put to air lines in operation through the continent?

The time is ripe for men to step in this marvellous and branch of human endeavor and achieve here what the Vanderbilts, the Huntingtons, the Harrimans, Edison and Ford achieved in their respective branches of human endeavor—and the League by its nation-wide campaign may find and bring to the Aeronautic Movement future Vanderbilts, Huntingtons Harrimans, Edison and Fords of the Air.

The world is waiting for great men to come who will be the great builder of airways, of trans-continental air trunk lines, of huge fleets of trans-atlantic airships, bridging the New World with the Old each day.

The world is waiting for the Harrimans, Huntingtons and Vanderbilts of the Air—Why Can't You Be One?

If you want to know how to begin and you want a start write to the Secretary of the Aerial League of America, 280 Madison Avenue, New York City. He will tell you how and direct your activities.

THIRD IMPORTANT LEGAL ACTION INSTITUTED TO UPHOLD THE LAW IN THE A. C. A. CASE

A THIRD important legal action has been instituted before the Supreme Court to compel the individuals who assumed temporary control of the Aero Club of America by violating the statutes to restore the Club's Board of Governors as it existed prior to the illegal meeting of and actions of August 16. As reported in AERIAL AGE for September 6th, a special meeting of the Club's members was then held on August 28, and notwithstanding the vacation season, one-third of the Club's membership attended the meeting in person or by proxy and voted to restore the Club as it was before the irregular meeting of August 16, and appointed a committee with authority to institute legal actions, if necessary, to protect the legal, moral and financial rights of the governors and members of the club whose rights and prerogatives have been abolished by the actions of these few individuals. This third legal action was instituted only after a reasonable length of time had been allowed to the defendants to proceed to restore the Club's Board of Governors. As no steps were taken to do so, and the so-called "new governors" proceeded to incur obligations in the name of the Club, action was started to remove these so-called new governors.

This action is of special importance as it is based on the basic principle that if it were possible for a few individuals, by misrepresentations and irregular actions at a rump meeting to abolish a board of directors prior to the expiration of the term of office stated in the bylaws of an organization and unanimously adopted at regular annual meeting, then the foundations on which the social and business structures are built would be subject to destruction at any time by any group of schemers and no man's interest in a business corporation would be safe.

Bill of Complaint in New Action

The bill of complaint filed by Nugent & Nugent, attorneys for the plaintiffs in this action sets forth, in part, that "persons claiming to be directors of said Aero Club of America and as a Board of its Governors have moved the Club House and furniture, trophies, etc., from the Club House, No. 297 Madison Avenue, Borough of Manhattan, City of New York, to No. 11 East 38th Street, Borough of Manhattan, New York City, and have assumed to take over the lease of premises located at said No. 11 East 38th Street and incur vast obligations of a financial character exceeding the present capacity of said Club and which actions if permitted to continue will involve said Club in financial difficulties and bankruptcy.

"That said alleged election and the proceedings, acts and matters touching the same were illegal and invalid because:

"First. Said meeting was not regularly or duly called in accordance with the Constitution and By-Laws of said Aero Club of America.

"Second. That the aforesaid amendments to the By-Laws are wholly and absolutely invalid, of no force or effect and contrary to law, and beyond the power even of the members to said Aero Club of America, in a meeting duly assembled, to enact. **That aforesaid Board of Governors of said Aero Club of America were duly elected to office, at regular annual meetings of the members thereof, for fixed terms specified in the Constitution and By-Laws of said Club, duly adopted and in force, and such members could not be removed from office prior to the expiration of their term, against their wishes and without just or any cause therefor.** Amendments of by-lays are ineffectual to terminate the tenure of office of any of said Governors and consequently no vacancies existed on such Board which could be filled at said alleged special meeting held on August 16, 1920. That your petitioner is aggrieved by, and complains of, such election and the proceedings, acts and matters touching the same, and alleges that said Board as now constituted is assuming to act for and bind said Aero Club of America in incurring ruinous obligations, and that aforesaid duly elected and qualified members of said Board of Governors are excluded from taking part in the deliberations of said Board and aforesaid persons are without any right whatsoever, assuming to exercise the duties powers and functions of a governor of said Aero Club of America to its irreparable damage and that your petitioner has been injuriously affected by the acts of said persons assuming to act as Governors thereof by virtue of said illegal proceedings.

"Wherefore your petitioner prays that such election may be declared by this court to be irregular and of no effect, and be set aside and the officers of all such directors be declared to be vacated and said Board restored to its duly elected and constituted directorate, and that all such persons assuming to be directors or governors or officers of said Club, by reason of said alleged election and the proceedings, acts and matters touching the same, cease to act as such; and for such further relief as right and justice may require.

"Petitioner asks that this motion be brought on by an order to show cause instead of the longer notice prescribed by the Code of Civil Procedure in order that great and irreperable injury and damage to said Aero Club of America and its members may be prevented."

Committee Protecting Right of Members Has Been Successful

The Committee which was formed to protect the legal, financial and moral rights of the absent Governors and members of the Aero Club of America, when the conspiracy to assume control and destroy the Aero Club of America became evident, has succeeded in defeating the aims of the schemers and has already four important accomplishments to its credit as follows:

(1) It stopped and prevented the scheme to wreck the Aero Club of America and make the Flying Club the national aero club of the United States which would have given control of aeronautic sport to the few individuals, employees and members of the Manufacturers Association whose methods have been condemned by the U. S. Senate Investigating Committee as "vicious and designed to make large profits by taking advantage of the necessities of the government."

(2) It exposed the pernicious activities of the individuals who were operating against the Aero Club of America through the Flying Club and forced the Flying Club to liquidate its affairs and go out of business;

(3) It prevented the scheme to use the Aero Club of America's treasury surplus to pay the obligations and deficits of the Flying Club;

(4) It exposed the methods of the schemers and by forcing them to try to give their schemes the semblance of decency, it prevented their turning over the control of the Aero Club of America to the so-called Manufacturers Aircraft Association, which is only a clique of half a dozen individuals, and also prevented the appointing of members of the so-called Manufacturers Aircraft Association on the Boards and Committees of the Aero Club of America.

All that the schemers have succeeded in doing has been that, by their high-handed methods they have taken possession of the furniture and records of the Aero Club of America, which they will have to surrender as soon as the legal actions which have been instituted come to trial.

THE NEWS OF THE WEEK

Complete First Transcontinental Aerial Mail Flight

The first transcontinental aerial mail service was completed when aeroplane No. 151 of the United States Aerial Mail Service landed at Marina Field, near the Presidio, on September 11. It covered the last 250 miles of the trip from Reno, Nevada, in one hour and fifty-eight minutes, and thereby broke all previous records for the same distance.

E. E. Mouton of Oakland, Cal., brought the machine in against a head wind. As soon as he landed, the six bags of mail were put on an automobile truck for distribution at the main post office. Postmaster Charles Fay and Colonel Wiliam V. Morgan, head of the aerial mail service on the coast, warmly greeted Mouton and later escorted him to the Olympic Club. Two bags of aerial mail left here on the 4 o'clock train for Washington, and one for Oregon, the other three remain in California.

On September 10, carrying 700 pounds of mail, the first transcontinental postal aeroplane to leave San Francisco cleared from the Marina Field at 6.15 A. M. R. J. Little was the pilot.

The schedule called for the plane's arrival in Salt Lake at 3.31 P. M., mountain time, the same day, and it was due at the Mineola Field, New York, at 4 P. M., September 12.

Three American Planes Arrive for Cup Race

Paris—The Verville-Packard army entry in the James Gordon Bennett cup race, the Texas Wildcat and the Cactus Kitten, the entries of S. T. J. Cox, have arrived at Villa Coublay, where they are to be set up and flown in test flights.

Captain R. W. Schroeder will test the army plane, Roland Rohlfs will fly the Texas Wildcat and Clarence Coombs will pilot the Cactus Kitten.

Intense interest is being evinced in Paris in the preparations for the trials. The race will be held September 27 to October 2.

Democrats Have Official Aeroplane

Not content with the aviation that Gov. Cox and Franklin D. Roosevelt have been doing on the stump, the Democratic National Committee announced yesterday they had appointed an official aviator.

William C. Jenkins, 321 Wyandotte street, South Bethlehem, Pa., has the distinction of being the first man to be named as an official aviator for a political committee. At headquarters Jenkins said he would use his aeroplane in distributing campaign literature in New York, Pennsylvania and New Jersey.

Holds Aerial Birthday Party

Huntington, W. Va.—An aerial birthday party, the first in the history of Huntington, was held by aviator Bob Shank as a surprise for his infant son, Robert Bruce, on the occasion of his first birthday, Saturday, September 4, to which a number of small children were invited.

The members of the party were given rides in the Shank aeroplane in pairs.

American Flyers Played Big Role in Budenny Rout

Warsaw.—The Kosciusko Squadron, the noted aerial force of Poland, comprised largely of Americans, played a prominent part in the defeat of Gen. Budenny, the Bolshevik cavalry commander, in Galicia.

An official statement mentions the splendid co-operation on the southern front of the flying escadrille, and it adds that it must be recognized that the aviators contributed in a considerable degree to the favorable development of our counter action, and it is at present, during the pursuit of the enemy, rendering wonderful services.

The southern front aviation service includes the Kosciusko Squadron, which is under command of Major Cedric Fauntleroy of Chicago.

S. E. J. Cox Sails for France

Mr. Seymour E. J. Cox, the Texas oil millionaire, who has expended $250,000 in preparation for the James Gordon Bennett international aviation race, sailed recently for France on board the Imperator with his wife and a party of five.

His two American racing planes, said to be capable of 200 miles an hour, have reached France.

Mr. and Mrs. Cox were guests at a farewell dinner at the Vanderbilt Hotel prior to their sailing for France on the Imperator. Twenty-five friends, including Glenn Curtiss, who once won the cup himself and whose company built the Cox racers, wished them good luck in their effort to bring the trophy to this country for the third time, which will mean its permanent retention here.

Among those who attended the dinner were Lieut.-Col. and Mrs. Benjamin F. Castle, Harry Boissot, Mr. and Mrs. Joseph Chapple, Gutzon Borglum, Mr. and Mrs. R. J. Beamish, A. J. Drexel Biddle, Joseph A. Steinmetz, president of the Aero Club of Pennsylvania, Capt. Claude R. Collins, president of the Aviators' Club of Pennsylvania, Edwin A. Fitzpatrick, city editor of the Baltimore

Making the U. S. Army Balloon which is to compete in the Gordon Bennett Trophy Balloon Race. The balloon has been constructed at Omaha under the direction of Mr. A. Leo Stevens, and was christened recently as U. S. A. No. 1. Immediately after the christening, First Lieutenant Richard E. Thompson, A.S., A. as pilot and Mr. A. Leo Stevens, Mr. Harry Lester, Master Sergeant C. M. Maricle, Sergeant P. L. Prom and Corporal J. M. Doud as passengers, took the balloon on its maiden voyage, of 55 miles, landing 2 miles northwest of Craig, Nebraska

Evening Sun, and Temple N. Joyce, of Baltimore.

Mr. Fitzpatrick and Mr. Joyce flew up from Baltimore in a Morane Saulnier monoplane to attend the dinner. They made the trip in two hours and ten minutes.

The diners and aeronautical men in general believe America's chances for lifting the Gordon Bennett Cup are excellent. There are two Cox-Curtiss entries, piloted by Roland Rohlfs, test pilot for the Curtiss Company, and Clarence Coombs, test pilot of the Ordnance Engineering Company.

Enthusiasm Aroused by Aerial League of the World

Major Charles J. Glidden, President of the Aerial League of the World, is receiving letters and telegrams of congratulation from all sections of the world upon the organization of the World's League, with requests for particulars as to the manner of proceeding to organize local leagues for the purpose of affiliating with the world-wide organization.

The world is alive to the science of aeronautics and tenders of cooperation are being received from all parts of the world, all that is asked is for uniform instructions as to the best method of proceeding to obtain results which are certain to be attained. The Aerial League of the World takes this method of informing all who have inquired and written them that they have in course of preparation a plan for local organizations covering all essential points which will be issued in a few days.

The league also wishes to thank all who have shown an interest in the advancement of aeronautics and the kind sentiments expressed in their communications.

Propose Glossary of Aviation Terms

London.—To facilitate international discussion of aviation, the Royal Aeronautical Society of Great Britain has prepared a glossary of aerial terms and is presenting it before the International Air Convention at Geneva, with the suggestion that it be adopted officially by that body. The glossary has been submitted already to American experts, and it is believed that they agree in the main with the nomenclature and definitions suggested.

The need of some such official list of terms has been felt on account of the rapidity with which aerial travel has grown. Certain terms in common use are purely slang and need turning into more precise expressions. The scientific and theoretical side of flight has been greatly developed, and so the Royal Aeronautical Society has prepared a set of mathematical symbols that will simplify technical discussions of dynamic problems. Meteorology is also covered by the glossary, and the uninitiated may learn from it that machines lighter than air are decorously equipped with trousers, petticoats and deflating sleeves.

Finally, the glossary considers the various types of lumber used in aeroplane construction and defines accurately the species of trees commonly referred to as larch, ash, elm, and so on.

Aerial Passenger Service in West Virginia

Clarksburg, W. Va.—For the purpose of engaging in passenger service throughout central West Virginia and maintaining an aviation school here, the Clarksburg Aircraft Corporation has been formed. G. C. White is president, C. H. Thrash, secretary-treasurer, and Ted Foredon, aviator in charge of the field operations.

U. S. Fliers in Trophy Meet Object to Field

American aviators who are to pilot planes in the Gordon Bennett trophy races at Paris this month are dissatisfied with the field designated as the starting point according to cable messages received by the Aero Club of America.

They have little hope of inducing the French Aero Club to change the designated starting field, which the Americans claim is small and unlevel.

Seaplane Flights at Westport

Westport-on-Lake Champlain.—Among sojourners at the Westport Inn and in the cottages, who are remaining in unusual numbers through September, popular sport is found in the daily flights aboard the six-passenger seaplane for which Northwest Bay is the starting point and landing station. Harry Rogers, who made a record flight in the machine from Miami, Fla., to New York, covering the distance in 15 hours 40 minutes is the pilot.

Aviation Recognized by Georgia Law

Atlanta, Ga.—Aviation in Georgia is given a recognized standing by a bill introduced in the Georgia State Senate. It defines aeronautic terms and license pilots. Registration fees are fixed at $5 a year for each aircraft; for examination of applicants for pilot licenses, $25; and pilot licenses, $2, and for duplicate copies of licenses, 50 cents each.

It provides for issuing of license numbers as for automobiles, and requires the number to be displayed on all aeroplanes in figures not less than three feet high.

In the Lower House, Price Gilbert's plan to regulate aerial traffic in Georgia was incorporated in a bill introduced by Mr. Neill of Muscogee. The bill provides for the registration of all aircraft, a licensing of pilots, plates and license tags for airships, a definition of legal terms relative to aircraft and conditions which must be met by non-resident pilots who seek to operate them in Georgia. It is the first bill of this nature introduced at this session.

Airscape view of Hollywood, California, showing the large motion picture studios and grounds where many scenarios are filmed

The AIRCRAFT TRADE REVIEW

A. W. Lawson Bidder on New Aerial Mail Routes

Washington—Bids were opened at the Post Office Department recently for aeroplane service by private contractors on three new routes. Alfred W. Lawson of Chicago put in the only tenders received.

He agreed to furnish service from Pittsburg to St. Louis via Columbus, Cincinnati and Indianapolis, for one year for $147,000. Between New York and Chicago, via Harrisburg, Pittsburg and Fort Wayne, the bid was $238,000 and between New York and Atlanta, via Washington, Raleigh and Columbia, $300,000. The Department said awards would probably be made in a few days.

Aerial Transportation Company in Pittsburgh

The Globe Aerial Transportation Company, of Pittsburgh, Pa., organized December, 1919, is engaged in the business of transportation between cities, carrying passengers, freight, mail, express and any other commodity that is profitable. It also does such additional things as advertising, photography and mapping.

The company is ready to act as agent or distributor for aeroplane manufacturers, importers, makers of aeroplane parts, aircraft insurance houses, etc.

Their first project is the establishment of an aerial transportation line between New York and Chicago, with landing stations in the following intermediate points: New York, Philadelphia, Harrisburg, Baltimore, Altoona, Johnstown, Pittsburgh, Youngstown, Akron, Erie, Cleveland and Chicago.

The officers and directors of the Globe Aerial Transportation Company are all progressive business men of western Pennsylvania. The officers are: Geo. K. Linderman, president; Elmer Trautman, secretary; William P. Martin, treasurer; Geo. W. Mulry, general counsel.

This company is anticipating putting into use planes of a carrying capacity of three tons of the all-metal type.

Aeronautical Engineering Courses

Due to lack of financial appropriations, the authorities of the College of the City of New York have decided to discontinue the aeronatical engineering courses. Feeling that the demand for this field of instruction should be catered to, Professors Van Muffling and Marx, who have been in charge of this work at the City College, are organizing a series of private lectures, including the most important phases of aeroplane construction and design. To accommodate the many requests from out-of-town students, the work is being extended so as to include instruction by correspondence. The work is being conducted along the same high standards that have given to the former aeronautic department of City College a nation-wide reputation. The courses already established include:

Aerodynamics, covering the fundamental theory of aeronautics and a study of phenomena leading up to design;

Aeroplane Design, which covers the actual design of a machine in illustration and gives the student an opportunity to develop and design a machine following any practical specifications of his own conception. This work is assisted by a course in

Aeroplane Drafting, in which the details of a modern aeroplane are reproduced on paper. Supplementing these courses, the important subject of,

Motors is fully treated in a series of lectures on the design of an aviation motor, supplemented by the practical work which is essential to the full presentation of the subject.

An extension of the work is planned to include the visiting of various aeroplane factories in the vicinity as well as practical erection and assembly work on one of the Long Island fields. The many requests for flying instruction in connection with this work has lead the organizers to enter into relations with flying fields all over the country for the accommodation of out-of-town students taking the correspondence courses.

Aeroplane Locates Body of Drowned Woman

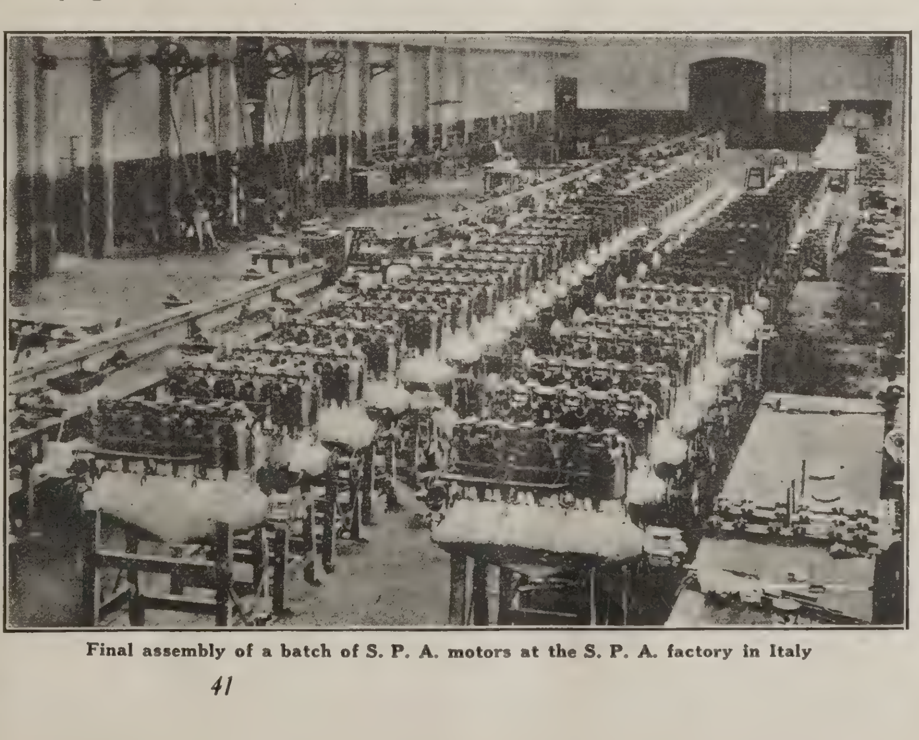
Southampton, L. I.—An aeroplane was recently used successfully in a search for the drowned here when volunteer fliers scouting along the Atlantic coast discerned floating near the Long Island shore the body of Miss Alice Wing, missing since she went rowing with William Russell, a 12-year old boy.

Hours before the aviator's hunt was rewarded, the rowboat in which the two started from Watermill, four miles from Southampton, was found, ending all hope that they were alive.

The flier swooped close to the body of Miss Wing, then signaled to other searchers in rowboats and motorboats who had kept up a long hunt for the bodies.

Pony Blimp to Attend California Fair

The Goodyear Pony Blimp which landed at March Field a short time ago will return to Riverside during the Southern California Fair, October 13 to 19 inclusive. Flights will be made from an adjoining landing field each day. It is expected that several passengers will be carried.



Final assembly of a batch of S. P. A. motors at the S. P. A. factory in Italy

Albert S. Burleson, Postmaster General
Otto Praeger, Second Assistant Postmaster General
Leon B. Lent, General Superintendent, Air Mail Service
Herbert Blakeslee, Assistant Superintendent
John A. Jordan, Chief of Construction
J. Clark Edgerton, Chief of Flying
Charles I. Stanton, Chief of Supplies and Maintenance
Carleton A. Parker, Assistant Chief of Maintenance
George L. Conner, Chief Clerk
John A. Willoughby, Operator in Charge of Radio Experiments
Eugene Sibley, Operator in Charge of Radio Maintenance and Operation

PILOTS

E. Hamilton Lee
Harold T. Lewis
James H. Knight
Walter H. Stevens
Robert H. Ellis
Randolph G. Page
Herbert M. Crader
Samuel C. Eaton
Elmer G. Leonhardt
Frederick A. Robinson
Walter J. Smith
Farr Nutter
Wesley L. Smith
Joseph P. Harris

Duard B. Colyer, Acting Superintendent, New York-Washington Division
Samuel F. Doane, Superintendent, New York-Cleveland Division
Walter H. Riddell, Superintendent, Cleveland-Chicago-Omaha Division
E. W. Majors, Superintendent of Repairs, Bustleton, Pa.
Eugene J. Scanlon, Manager, Air Mail Warehouse, Newark, N. J.
Paul W. Smith, Manager, Newark, N. J.
Maurice J. Kelly, Manager, Bellefonte, Pa.
Howard F. Salisbury, Manager, Cleveland, O.
Andrew R. Dunphy, Manager, Chicago, Ill.
William I. Votaw, Manager, Omaha, Neb.

PILOTS

Cecil R. Benedict
Oscar B. Santa Maria
James T. Christensen
Elmer C. Nichols
John J. McLaughlin
Harry Huking
Glenn V. Conrad
Irving Murphy
Claire K. Vance
Homer W. Johnston
William N. DeWald
Clarence C. Lange
William C. Hopson
W. J. McDonough
D. A. Martin

Prizes for Pilots on Transcontinental Aerial Mail Service

Five newspapers along the route of the Transcontinental Aerial Mail, which opened Wednesday, September 8, have united in offering a prize of $1,000 for the three best mileage records made on any division between New York and San Francisco, Otto Praeger, Second Assistant Postmaster General, announced today. The donors are the *New York Evening Post, Chicago Tribune, Omaha Bee, Salt Lake Tribune*, and a Cleveland, San Francisco or Sacramento paper yet to be selected. The prize will be divided into three parts, $500 first, $300 second, and $200 third. The period of contest will be six months from the start of the service. Details are being arranged by a committee representing the Contest Committee of the Aero Club of America and the Aerial Mail Service. De Haviland 4's and Curtiss R-4's equipped with the Liberty engine, L. W. F.'s equipped with Isotta engines and the J-L-6 all-metal monoplanes are to carry the mail. The flights west will be handicapped by strong opposing winds, but this disadvantage will be neutralized on the flights east. The prize announcement has greatly stimulated interest among pilots in the Transcontinental Aerial Mail Service.

Aerial Mail Service in Mexico

Mexico City.—Establishment of aerial mail service between Mexico City and Tampico has been determined by the government, according to Cosme Hinojosa, postmaster general.

By authorization of Provisional President Adolfo de la Huerta, a small flotilla of aeroplanes, of Mexican manufacture, will be utilized.

It is believed that the trip from Mexico City to the gulf port can be made in about three hours. There will be no intermediate stops. A trial flight will be made before the end of the present month, it was announced.

Hangar for Aerial Mail Service Soon Ready

Reno, Nev.—Construction of the hangar at the Municipal Landing Field has been progressing rapidly and is now ready for use by the United States Aerial Mail Service. Mayor Stewart reported the field has been placed in excellent shape.

The Federal officials now in Reno are preparing for employment of a corps of mechanics and clerks as soon as the repair shops can be erected and equipment installed.

UNITED STATES POST OFFICE DEPARTMENT

NEW YORK-WASHINGTON DIVISION—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, June, 1920

Aeroplane No.	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallon of Gasoline	Total Time Run hr. min.	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
12	$20.44	$2.87	$52.66	$50.11	$17.12	$26.24	$39.60	$76.74	$71.18	$46.24*	$35.24	$438.44	73	6 15	413	5.7	$70.15	$1.06
14	6.44	6.15	52.66	50.11	17.12	26.24	....	93.02	39.75	46.24	35.24	372.97	23	....	....	....	....	.....
16	27.44	12.38	52.66	50.11	17.12	26.24	2.11	206.94	89.76	46.24	35.24	566 24	98	.. 20	35	.4	....	16.18
30	215.18	36.17	52.66	50.11	17.12	26.24	126.51	173.70	35.24	72.50	35.24	840.67	766	19 58	1,400	1.8	42.10	.60
31	75.04	10.23	52.66	50.11	17.12	26.24	46.25	227.36	298.98	72.50	35.24	911.73	268	7 18	585	2.2	124.89	1.56
33	68.64	4.92	52.66	50.11	17.12	26.24	4.22	342.42	3,583.15	72.50	35.24	4,257.22	239	.. 40	128	.2	....	33.26
34	59.00	11.68	52.66	50.11	17.12	26.24	28.51	78.06	2.00	15.58*	35.24	376.20	200	4 30	390	1.9	83.60	.96
35	262.56	54.54	52.66	50.11	17.13	26.25	180.73	312.54	54.65	72.50	35.24	1,118.91	932	28 32	2,390	2.6	39.21	.47
36	365.10	45.28	52.66	50.11	17.13	26.25	226.51	335.09	17.34	72.50	35.24	1,243.21	1,301	35 45	2,741	2.1	34.77	.45
42	33.04	6.03	52.66	50.11	17.13	26.25	6.86	49.27	15.25	3.96*	35.24	295.80	118	1 05	100	.8	273.04	2.96
43	30.80	8.96	52.66	50.11	17.13	26.25	8.66	91.30	12.62	72.50	35.24	406.23	110	1 22	150	1.4	297.24	2.71
48	61.04	6.58	52.66	50.11	17.13	26.25	23.76	63.43	10.03	48.00*	35.24	394.23	218	3 45	310	1.4	105.13	1.27
50	246.00	42.88	52.66	50.11	17.13	26.25	162.10	226.05	135.12	72.50	35.24	1,066.04	875	25 35	2,145	2.5	41.66	.50
89	21.00	4.20	52.66	50.11	17.13	26.25	18.48	5.51	....	2.12*	35.24	232.70	75	2 55	195	2.6	79.78	1.19
108	192.92	25.48	52.66	50.12	17.13	26.25	206.45	291.62	166.80	50.00	35.24	1,114.67	689	32 35	3,395	4.9	34.21	.33
109	....	....	52 66	50.12	17 13	26 25	....	15.07	....	50.00	35.25	246.48	.....	....	....	....	....	.....
110	....	....	52.66	50.12	17.13	26.25	....	32.14	538.59	7.15*	35.25	759.29	.....	....	....	....	....	.....
44301	9.24	1.40	52.66	50.12	17.13	26.25	28.72	78.26	5.60	35.00	35.25	339.63	33	4 32	270	8.1	74.91	1.26
44305	31.36	2.66	52.66	50.12	17.13	26.25	45.94	55.59	10.00	35.00	35.25	361.96	112	7 15	435	3.9	49.92	.83
Total	$1,725.24	$282.41	$1,000.54	$952.14	$325.40	$498.68	$1,155.41	$2,754.11	$5,086.06	$893.03	$669.60	$15,342.62	6,130	182 22	15,082	2.5	$84.13	$1.02

Cost per mile, overhead, $0.25; cost per mile, flying, $0.21; cost per mile, maintenance, $0.56.
Cost of rebuilding one Curtiss R4 plane outside of our Service, $1,466.51.
Planes Nos. 12 to 16, inclusive, Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
planes Nos. 30 to 50, inclusive, Curtiss R4, equipped with Liberty 12 motors.
Planes Nos. 89 to 110, inclusive, De Haviland, equipped with Liberty 12 motors.
Planes Nos. 44301 and 44305, Curtiss JN4D, equipped with Curtiss OX5 motor.
*Indicates plane appears on another report.

OTTO PRAEGER, Second Assistant Postmaster General.

PROPERTIES OF WOODS AT 10 PER CENT MOISTURE

By B. C. Boulton, Aeroplane Section, and R. L. Hankinson, Materials Section, McCook Field

(Continued from page 30)

The Relative Merits of Woods

In Table 4 the woods are arranged in their order of relative merit based on their properties per unit weight. In calculating this table certain properties were weighted as follows:

Work to maximum load in static bending	2.0
Fiber stress at elastic limit in static bending	1.5
Modulus of rupture	2.0
Modulus of elasticity	2.0
Fiber stress at elastic limit in impact bending	1.5
Ultimate compressive strength parallel to grain	1.0
	10.0

Work to maximum load represents the ability of the timber to absorb shock, after the elastic limit is passed, with a slight permanent or semi-permanent deformation and with some injury to the timber. This property is a measure of the combined strength and toughness of a material under bending stresses, and is therefore of great importance in aeroplane parts which are subjected to severe shock as in chassis struts, to large suddenly applied leads, or to severe vibration. On small high-powered machines, toughness is particularly essential. A wood may be high in its elastic properties, but if it is low in toughness it will not be so suitable for most aeroplane construction as a somewhat weaker, but tougher wood. A wood lacking in toughness is said to be brashy. Brashness may be either natural or artificial. Wood may be said to be naturally brash, when one of its characteristic features is low work properties. However, any species may contain brash material due to obtaining lumber from very old mature trees, or by being effected by fungus growth or decay. Wood may be said to be brash due to artificial causes when it has been subjected to high temperatures or very rapid drying.

The stresses that are developed in service should always be within the elastic limit of the material. Occasionally, however, under very severe conditions the elastic limit will be exceeded, and if the load continues for more than a short time gradual failure will ensue. Since working stresses are ordinarily based on ultimate stresses rather than on elastic limit values, a material with an elastic limit close to its ultimate strength is much superior to a material of the same ultimate strength but with a low elastic limit.

The weights given the different properties in determining the relative merit of the woods, as shown in Table 4, were chosen with the purpose of selecting woods best fitted for general aeroplane work. In wing beams, all the properties which were considered in preparing Table 4 are of importance, and therefore the order of merit as indicated by this table is closely correct for this type of member. But in other portions of the structure only certain properties are of importance. For example, in selecting the best wood for a tail skid only the modulus of rupture, the work to maximum load and the fiber stress at the elastic limit in impact bending need be considered. In the case of a slender strut the modulus of elasticity is the most important property, though consideration should also be given the work to maximum load. For short struts, on the other hand, the ultimate compressive strength becomes more influential than the modulus of elasticity. It should be noted that in certain members, especially slender struts, where the strength varies as the moment of inertia, that in comparing woods of different specific gravity it is incorrect to use the first power of the ratio of the weights of the woods. The heavier species give a smaller strut for the same strength, but, since the strength varies directly as the cube of the diameter, the material in the smaller strut is not so effectively placed, thus decreasing the advantage of the heavier, stronger material. In designing members subjected to different kinds of stresses, an engineer should decide what properties are important and what their relative importance is. By the aid of the comparative values in Table 4 he can then quickly determine which wood is best adapted to any particular purpose, always bearing in mind that on large, heavy aeroplanes the shock-absorbing properties are less essential than on fast, high powered scouts where vibration is severe. Column 10 of this table shows numerically the relative advantages of the different woods as far as their strength properties only are concerned. Other factors beside strength properties must be considered also.

TABLE 4.

Properties of Woods in Terms of Properties of Spruce

Wood*	Wgt. per cu. ft.	Static Bending				Impact Bending	Ultimate Compres'n	Sum of Wgtd. Values	Col. 9
		Work to Maximum Load	Fiber Stress at Elastic Limit	Modulus of Rupture	Modulus of Elasticity	Fiber Stress at Elastic Limit	Strgth. Parallel to Grain	10	Col. 2
1	2	3	4	5	6	7	8	9	10**
Cedar (Port Orford)	1.15	1.18	1.24	1.34	1.32	1.43	1.22	1.29	1.12
Birch	1.65	2.08	1.81	1.80	1.42	1.97	1.66	1.79	1.08
Norway Pine	1.22	1.17	1.57	1.32	1.21	1.40	1.36	1.32	1.08
Hickory	1.89	2.80	1.69	2.06	1.49	1.96	1.69	1.99	1.05
Black Ash	1.28	1.71	1.26	1.37	1.12	1.05	1.17	1.30	1.01
Spruce	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fir (Grand, etc.)	1.00	.93	.97	.99	1.07	.92	1.05	.986	.985
Black Cherry	1.29	1.23	1.55	1.30	1.01	1.21	1.34	1.26	.977
Western White Pine	1.09	1.03	1.02	1.00	1.07	1.15	1.14	1.06	.973
Poplar	1.20	1.23	1.10	1.14	1.05	1.29	1.10	1.15	.960
African Mahogany	1.22	1.23	1.36	1.18	1.02	......	1.04	1.17	.959
Basswood	.98	.89	.99	.92	.99	.89	.91	.933	.953
Hard Maple	1.57	1.52	1.58	1.56	1.21	1.65	1.47	1.49	.950
Commercial White Ash	1.46	1.53	1.34	1.42	1.07	1.48	1.31	1.36	.930
Douglas Fir	1.30	.88	1.21	1.16	1.36	1.03	1.41	1.16	.893
Eastern White Pine	1.00	.71	1.03	.92	.94	.79	1.06	.893	.893
Black Walnut	1.44	1.08	1.48	1.39	1.11	1.31	1.31	1.26	.877
Elm	1.68	2.08	1.26	1.53	1.05	1.47	1.33	1.47	.872
Hemlock Western	1.07	.67	.86	.93	.97	.90	1.10	.888	.830
True Mahogany	1.33	.92	1.35	1.09	.91	......	1.12	1.06	.797
Oak (Bur, Cow, etc.)	1.72	1.37	1.21	1.37	1.05	1.53	1.26	1.29	.750

*The only species permitted are those given in Table 2, Column 2.

**In computing values in Col. 10, the weight per cu. ft. was raised only to the first power, which is correct for beams where the depth would not vary with the species of wood chosen, but is not correct for certain members, such as struts. In cases where a species is unusually low in any one strength property, as shown in Cols. 3-8, inclusive, it may not be as suitable as another species whose index figure in Col. 10 is lower.

Comments On Different Species

Other characteristics than strength must be considered in deciding on the value of a wood for a certain purpose. The comments which follow are based on a report by Mr. J. A. Newlin, in charge of timber mechanics at the Forest Products Laboratory.

A material should dry readily, stay to the place well, and not develop serious defects, such as shakes, checks or rot. The way a wood works under the tool, the finish it takes, and all manufacturing conditions must be considered, as well as the size of the trees and the defects normally found in the species. Frequently high grade stock of an inferior species is better than low grade material of a superior species.

Port Orford Cedar. Recent data on this species is not quite so favorable as that given in Table 2.

Douglas Fir. This wood is considerably harder to dry than spruce and is more inclined to shakes, and to checks, and to check during manufacture and to develop these defects in service. It is inclined to break in long splinters and to shatter when hit (a serious defect in certain types of military aeroplanes). The use of Douglas fir in the manufacture of wing beams will require considerably more care than is necessary with spruce, but it should give very excellent results when substituted for spruce in the same sizes.

Western White Pine. It is more difficult to dry than eastern white pine, but could be very satisfactorily substituted for spruce in spruce sizes.

Eastern White Pine. Tests show this wood to be somewhat below spruce in hardness and rather low in shock-resisting ability. It, however, runs quite uniform in its strength properties, is very easily kiln-dried without damage, works well, stays to its place well and is recommended as a substitute for spruce in spruce sizes.

Black and Commercial White Ash. These woods are well adapted to steam bending.

Basswood. Basswood is one of the best species to receive nails without splitting, and is used extensively for webs, veneer cores, etc.

Birch. Sweet and yellow birches are quite heavy, hard and stiff. They have a very uniform texture and take a fine finish. On account of their hardness and resistance to wear they can be used to face other woods to protect them against abrasion. Birch is extensively used in propeller and plywood construction.

Black Cherry. This is a very desirable propeller wood.

Poplar. Of the three species listed under this name, cucumber is considerably the best, while yellow poplar is the weakest. Cucumber is one of the few hardwoods which gives promise of being a good substitute for spruce. Magnolia is similar to cucumber. Yellow poplar, while rather low in shock-resisting ability, has good working qualities, ability to retain its shape, and freedom from checks, shakes and such defects, characteristics which make it a fairly satisfactory substitute for spruce. It presents no manufacturing difficulties. Poplar is used to some extent in propeller construction.

Elm. This species is low in stiffness though very resistant to shock. It steam bends well, and if properly dried can be used for longerons as a substitute for ash, which is somewhat lighter. Considerably more care is necessary in the drying of elm in order to have it remain in shape, as it twists and warps badly when not held quite firm. White and slippery elm when of the same density as rock elm may be substituted for the latter. A lighter grade of white elm could probably be used to excellent advantage in the bent work at the end of wings, rudders, elevators, etc.

Sugar Maple. Sugar maple is quite heavy, hard and stiff. It should be used along with birch in propeller manufacture. It has very uniform texture and takes a fine finish. Like birch it is often used to protect other woods against abrasion.

Oak. The oaks need not be considered as substitutes for spruce, but they play an important part in the manufacture of propellers. They are all quite heavy and hard, and are extremely variable in their strength properties. White oaks, as a rule, shrink and swell more slowly with changes in the weather than do red oaks. Because radial shrinkage in oaks is about half the tangential shrinkage, quarter sawn oak is much superior to plain sawn oak for propeller construction. Southern grown oaks are much more difficult to dry than are the northern oaks. Northern white oaks when quarter sawn and carefully dried give very satisfactory propellers. Quarter sawn northern red oaks are fairly satisfactory for propeller construction, but they have the disadvantage of being more subject to defects in the living tree, decay more readily, and change more rapidly with change in weather conditions.

Black Walnut. This wood need not be considered at all as a substitute for spruce. But it probably makes the best propeller of any of the native species. Black walnut is somewhat difficult to dry, but has very excellent power of retaining its place and has good hardness to resist wear.

Summary. Data available indicates strongly that the following species can be substituted for spruce in highly stressed parts: Port Orford Cedar, Coast Type Douglas Fir, Amabilis, Grand, Noble and White Firs, Eastern and Western White Pine, Yellow Poplar, Cucumber and Magnolia. Certain other woods give good promise of furnishing spruce substitutes, though more work is necessary to overcome known difficulties before they can be definitely recommended: Lodgepole Pine, Norway Pine, and Redwood.

Mechanical Tests for Struts and Beams

Because of the large variations in the strength properties of any given species of wood, it is necessary to select the material for aeroplane parts carefully, and then give the finished members a rigid inspection. Unfortunately, visual inspection is unsatisfactory. During the war the rejections of expensive finished parts were very large. In order to determine whether these rejections were justified, the Forest Products Laboratory tested numbers of aeroplane struts, both those which had been passed and those which had been rejected. To the surprise of the engineers, some of the highest strengths were obtained from the rejected struts and very many of these were found to be entirely acceptable, while quite a few of the struts which had passed inspection were below the requirements. In this connection it should again be stated that spiral grain affects the modulus of elasticity less than the other strength properties, and that therefore it is not as a serious defect in interplane struts as in wing beams.

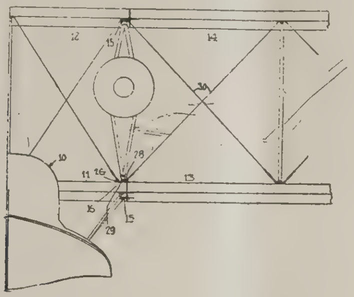
Simple and valuable methods have been developed to supplement visual inspection. The easiest of these is the determination, by weighing a member, of the approximate specific gravity of the material. Since the variation in the specific gravity of wood fibers is negligible, differences in the density of two specimens of wood having the same moisture content are directly proportional to the amount of wood fiber in each specimen. With few exceptions, the strength of wood of any one species varies directly with its specific gravity, based on oven dry weight. Hence, if the weight of any given member, based on some average moisture content and a specific gravity fairly well above the minimum allowable, is determined by actual weighing or by computation, then all similar parts, if they come above this weight and pass visual inspection, can be safely assumed satisfactory. Members with a weight below standard, or having visible defects, should be classed as doubtful and be subjected to a strength test. In computing the specific gravity of a member allowance should be made for shrinkage, since minimum specific gravities are usually based on oven dry weight and oven dry volume. As most material is kiln-dried, it will run fairly uniform in moisture content. An average value to assume can be found by making occasional moisture determinations.

The strength characteristics can be readily obtained by a simple test in which the modulus of elasticity is determined. For slender struts this gives directly the strength of the member, and for beams it serves as a good criterion for the other strength properties. The modulus of elasticity can be found from a bending test, the member being supported at each end and subjected to a single concentrated center load. Under these conditions the deflection, which is accurately measured by a multiplying lever, equals $\frac{WL^3}{48\ EI}$, or $E = \frac{WL^3}{48\ dI}$. For any one member a curve can be drawn from which the value of E, or in the case of a strut the maximum strut load, can be read for any deflection. This ultimate strut load is computed by substituting the correct value for E in Euler's formula, $P = \frac{\pi^2\ EI}{L^2}$. A slender strut is unique among structures in that it can thus be tested to its ultimate load without the slightest injury. Although the strength of a wing beam depends upon the modulus of rupture and ultimate compressive strength of the material more than on the modulus of elasticity, yet the latter property is a good indication of the quality of the material. Hence, if the modulus of elasticity of a spar is determined by test in the same manner as it is for a strut it serves as an excellent basis for the acceptance or rejection of the beams.

The apparatus (Fig. 2) for making strut and beam tests is very simple. A dynamometer is used for measuring the applied load. In production, the methods of inspection that are suggested here are inexpensive and rapid, as well as very much more reliable than the old system of visual inspection. A large number of struts or beams that would normally be rejected can be safely passed on the basis of these strength tests. What is more important is that the material or true safety factor that covers the variability in strength of the wood can be reduced appreciably.

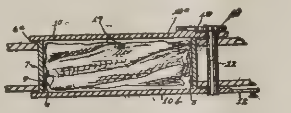
RECENT AERO PATENTS

1,306,764. AEROPLANE-WING HINGE. Henry Kleckler, Buffalo, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, a Corporation of New York. Filed April 16, 1917. Serial No. 162,532. 3 Claims. (Cl. 244—31.)



1. An aeroplane wing truss including wing panels arranged to provide separable wing cells together with wiring cross arranged between the panels of one cell, the wiring at one end extending beyond the particular cell which it cross braces for connection with an adjacent cell to firmly tie the adjacent cells together.

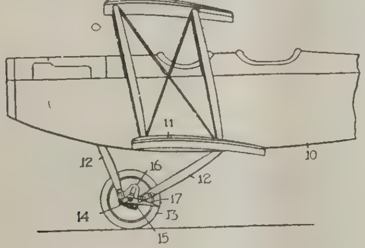
1,293,359. AEROPLANE WING. John C. Davidson, Columbus, Ohio. Filed Oct. 8, 1917. Serial No. 195,245. 2 Claims. (Cl. 244—21.)



1. In an aeroplane, combination with the wings thereof, of a plurality of receptacles carried by said wings, foldable parachute members adapted to occupy each of said receptacles, means for releasing said members from said receptacles, comprising for each receptacle a pair of upper and lower swinging plate members, a shaft common to both of said plates and by means of which the latter are oscillated, a ratchet wheel mounted upon the upper end of said shaft, a spring pressed dog movable into engagement with the teeth of said ratchet, and cable means connected with said plates to oscillate the latter to positions covering and uncovering said receptacles and through the co-operation of a shaft carried ratchet mechanism to effect the oscillation of said upper plate to a receptacle uncovering position only.

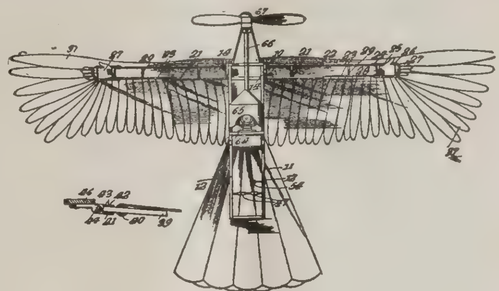
2. In an aeroplane, the combination with a plane thereof, a foldable parachute member situated in an opening formed in said plane, of means for retaining said member within said opening and to permit of its release therefrom, comprising a pair of spaced oscillatory upper and lower plate members normally situated to cover said opening, cable means connected with said plate members to oscillate the latter to opening uncovering positions, and means co-operative with the upper plate member to permit the latter to be oscillated to an opening uncovering position only.

1,306,751. COMBINATION LANDING GEAR FOR AEROPLANES. Glenn H. Curtiss, Garden City, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, Buffalo, N. Y., a Corporation of New York. Filed March 13, 1918. Serial No. 222,214. 4 Claims. (Cl. 244—2.)



1. In an aeroplane, the combination of a landing gear including ground runners adapting the machine to arise from and alight upon the ground, a cross connection between the runners, a principal aerial supporting surface adapting the machine to aerial flight, and a cambered auxiliary supporting surface carried by the landing gear and streamlining the cross connection between the ground runners, the cross sectional form of said aerial auxiliary supporting surface being such that the machine is adapted to alight upon the water should occasion demand.

1,298,773. AEROPLANE. Joseph N. G. Nesbit, Atlanta, Ga. Filed Oct. 27, 1917. Serial No. 198,823. 5 Claims. (Cl. 244—20.)

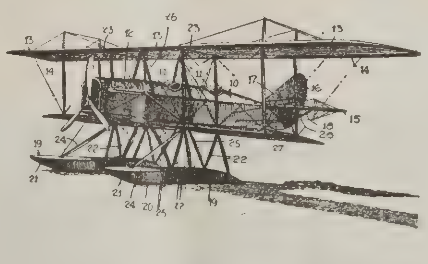


1. In a flying machine, a frame, a rotatably mounted arm at each side of the frame, a system of linkage connected to each rotatable element, means for strapping each system of linkage to an arm of the operator and a plane mounted on each system of linkage whereby the planes may be oscillated vertically, or inclined transversely relatively in opposite directions, or simultaneously in the same direction.

3. In a flying machine, a frame, a system of linkage mounted at each side, the joints of the links being located at points coincident with the joints of the arms, means for strapping each system of links to one of the arms of the operator, a glove mounted at the outer end of each system of linkage, means connecting each system of linkage to the frame to permit rotative axial movement of each system of linkage, and to permit vertical movement of each system of linkage, and a plane mounted on each system of linkage with a portion of each plane carried by one of the gloves.

5. In a flying machine, a tail, means mounting the same for movement vertically and, laterally, a pair of oscillatably mounted foot pedals, means operatively connecting each pedal to the tail, to move the same vertically upon oscillation of the pedals, and an auxiliary pedal carried by each of said first mentioned pedals, and means connecting the auxiliary pedals to the tail whereby to oscillate the tail laterally upon oscillation of said auxiliary pedals.

1,306,757. DEVICE FOR INDICATING THE PRESENCE OF ARTICLES IN PIGEONHOLES. George F. Fleckenstein, Sioux City, Iowa. Filed Oct. 12, 1917. Serial No. 196,102. 3 Claims. (Cl. 40—16.)



5. In an aeroplane, a fuselage, a supporting surface including a central panel, landing devices mounted beneath the supporting surface and symmetrically at opposite sides of the fuselage with their longitudinal center lines in the longitudinal vertical plane of the ends of the panel, and struts transversely downwardly divergent from the ends of the panel for the support of the landing devices.

THE GRAHAME-WHITE AERO-LIMOUSINE

ALTHOUGH in general design and construction the Grahame-White Aero-Limousine presents nothing of unusual practice, a close inspection reveals a careful consideration of every detail that makes for efficient and thorough design. The ultimate use to which this machine is to be put has been borne in mind in the design of each detail throughout. It has been the aim of the designer, M. Boudot, to produce in this machine the safety, combined with the comfort, of the passengers, and reliability rather than mere performance, and the question of weight has not been allowed to predominate over strength, utility and comfort.

The Aero-Limousine is a biplane fitted with two engines driving direct four-bladed tractor-propellers. The passengers' cabin, which is in the extreme nose of the fuselage is most comfortably and luxuriously fitted. The whole cabin is similar to a first-class motor-car body, even to the outside finish. In this model provision is made for four passengers, seated in pairs tandem fashion, the left-hand front seat being hinged so as to swing back and give access to the front seats. In future models it is proposed to lengthen the cabin and provide two additional tip-up seats giving a seating accommodation for six passengers. The whole of the interior of the cabin is upholstered in a neat grey Bedford cord, and large triplex windows, extending completely round the sides and front of the cabin, give plenty of light and afford an excellent view in every direction. A large door on the left side of the cabin, well clear of the propeller, and a strong foot-step allow of easy access. There is an adjustable ventilator in the nose of the cabin, and two air-outlets in the rear of the roof for ventilation. Communication can be made with the pilot by means of a speaking tube.

The pilot's cockpit is situated at the rear of and immediately above the cabin. It is exceptionally roomy and comfortable, and ample protection is provided by means of a sort of conning tower. All the instruments are located in the cockpit, and the engine and gasoline controls are located on the right and left-hand sides respectively.

The control is of the wheel and rudder bar type, the arrangement of the rudder bar being most noteworthy. The bar is mounted below the cockpit floor, in which are cut two slots having their edges reinforced on the top by steel plates. Working in these slots, and sliding on the plates, are the foot pedals, which are connected to the rudder bar by a spindle extending below each and working in a slot in the rudder bar. On the left of the pilot's seat is a hand-wheel operating the tail plane incidence gear.

In construction the fuselage follows more or less standard practice, the rear portion aft of the cabin being of wire-braced girder construction with square section longerons and channel-section struts, the last bay being braced laterally by three-ply. The fore portion of the fuselage is built up on hoop-formers of ash reinforced with three-ply, thus giving a straight-through construction with no wire cross-bracing. Where the formers are exposed to view inside the cabin, they are covered with a thin veneer of mahogany. The outer covering is three-ply and fabric for the cabin, and doped fabric for the rear portion.

The main planes are built up in seven sections, comprising a centre section of about 20 ft. span and two outer sections for the top plane, and a similar arrangement for the lower plane, except that the centre section is divided into two by the fuselage. The outer sections are hinged at the roots of the rear spars so as to fold back, thus facilitating housing, the overall width folded being 28 ft. Both upper and lower outer sections are given a dihedral angle of 4 degrees, but have neither stagger nor sweepback.

The tail plane, which is rectangular in plan form, is of symmetrical streamline section, and its angle of incidence can be varied during flight. The elevators are unbalanced and divided, while the rudder is balanced. A large vertical fin is mounted above the fuselage. All the tail surfaces are braced by cable and steel struts, which are streamlined.

An exceptionally strong and efficient landing chassis is fitted, consisting of two separate units, the main landing gear, and an emergency gear. The latter prevents the machine from tipping on her nose, and takes the weight of the machine should the main chassis fail. It consists of two large wheels rigidly mounted on the fuselage, in advance of the main wheels.

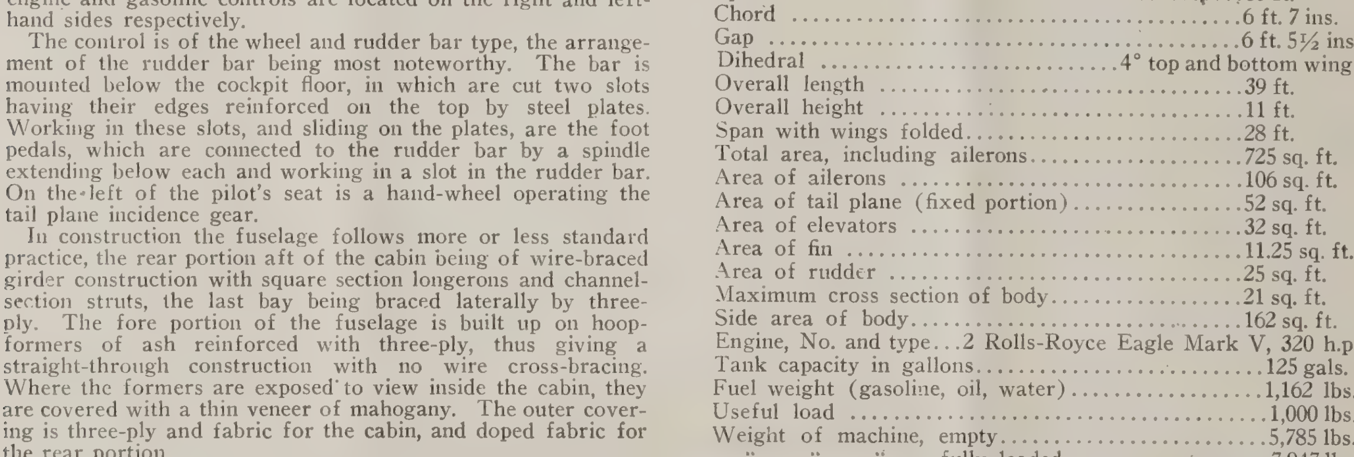
The two wheels of the main landing gear are situated under the engines, and are connected to the main plane and fuselage by a triangular system of tubular members. The shock-absorbing device incorporated into the front strut of the vee, consists of a set of steel springs combined with an oil dashpot. The power unit consists of two Rolls-Royce Eagle Mark V engines, of 320 h.p., mounted one on each side of the fuselage between the top and bottom planes. They are carried in strong tubular steel mountings, with the radiators in front. The engines can be started either by means of a starting handle, mounted on the rear of each engine, or else by way of a magneto-starter from the cockpit.

The main gasoline tank is located immediately behind the pilot's cockpit, whilst the gravity tanks are mounted in the centre section of the top plane. The gasoline supply is maintained by two windmill pumps mounted in the slipstream of each tractor screw just below the lower plane centre section. There is also an auxiliary pump operated from the cockpit.

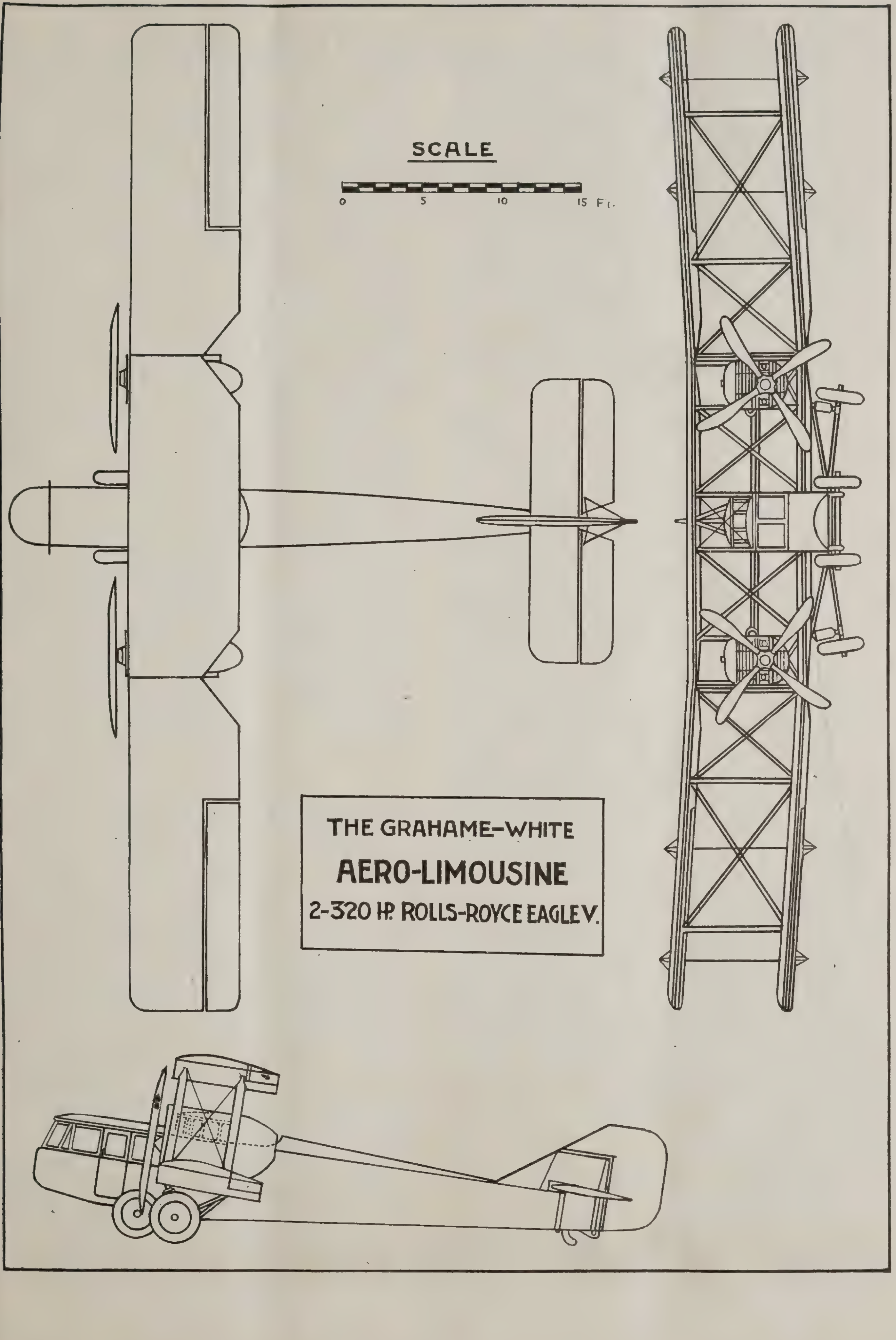
General specifications and performance of the Grahame-White Aero-Limousine:—

Span	60 ft.
Chord	6 ft. 7 ins.
Gap	6 ft. 5½ ins.
Dihedral	4° top and bottom wings
Overall length	39 ft.
Overall height	11 ft.
Span with wings folded	28 ft.
Total area, including ailerons	725 sq. ft.
Area of ailerons	106 sq. ft.
Area of tail plane (fixed portion)	52 sq. ft.
Area of elevators	32 sq. ft.
Area of fin	11.25 sq. ft.
Area of rudder	25 sq. ft.
Maximum cross section of body	21 sq. ft.
Side area of body	162 sq. ft.
Engine, No. and type	2 Rolls-Royce Eagle Mark V, 320 h.p.
Tank capacity in gallons	125 gals.
Fuel weight (gasoline, oil, water)	1,162 lbs.
Useful load	1,000 lbs.
Weight of machine, empty	5,785 lbs.
" " " fully loaded	7,947 lbs.
Surface loading	10.96 lbs. per sq. ft.
Power loading	12.4 lbs. per b.h.p.
Maximum speed at ground level	116 m.p.h.
Maximum speed at 10,000 ft.	105 m.p.h.
Speed at ¾ throttle	104 m.p.h.
Landing speed	50 m.p.h.

Climb to 5,000 ft., 4 mins.; to 10,000 ft., 9.9 mins. Ceiling, 17,000 ft.



Three-quarter front view of the Grahame-White five passenger Aero Limousine, equipped with two 320 H.P. Rolls-Royce Eagle V engines



THE GRAHAME-WHITE
AERO-LIMOUSINE
2-320 HP. ROLLS-ROYCE EAGLE V.

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FABRIC AND DOPE, WITH SPECIAL REFERENCE TO DETERIORATION OF STRENGTH AND TAUTNESS

By F. W. ASTON, M. A., D. Sc., A. I. C., of the R. A. E.

ABSTRACT.

THE first part of the paper deals with the action of light in deteriorating the strength of doped and undoped linen aeroplane fabric. Sunlight is shown to be the only serious agent. A curve is given showing the change in rate of loss of strength throughout the year, the effect being very great in summer and practically negligible in winter. A comparison of the weathering properties of German and British material is given. Experiments are described which indicate the loss of strength is due to the action of ozone formed by ultra-violet light, the distribution of the destructive power in the spectrum corresponding very well with a photo-electric theory of the formation of ozone proposed by F. A. Lindenmann. The efficiency of dyes and pigments as protective agents is shown to be excellent, but the latter are to be preferred on account of their effect in improving the tautness given by the dope.

The second part of the paper deals with tautness and its measurement, the more important methods are discussed, and a standard one proposed by which the tautness can be expressed directly as a tension. A description of the standard frames and the system of measurement of tautness at high humidities at present used at the R. A. E. is given. A theory to account for the tautening effect of dope is suggested.

At the beginning of the war little had been published concerning the functions and weathering properties of dope. It was known that when doped fabric was exposed the dope layer cracked sooner or later, and it seems to have been generally believed that deterioration both of tautness and strength was due to such cracking. As it was expressed at that time, "the dope cracked and let the weather get through to the fabric." Though clearly more or less correct as regards tautness, which is a function of the dope layer principally, we now know that as regards strength, which is chiefly due to the fabric, this idea is entirely wrong. It is not difficult to see why, for after all, under reasonable aerodrome conditions, the word "weathering" only expresses the action of four things—air, moisture, sunlight, and change of temperature. Air can get to the fabric on the undoped side, cracks cannot affect the results of temperature nor, if the dope be transparent, those of sunlight. Experiments have been actually carried out to find if clean water gave any appreciable deterioration, but the negative result obtained was a foregone conclusion, for in the process of retting before it is woven the linen is allowed to steep in water for very long periods. Nevertheless, at that time energies were largely directed to the preparation of flexible varnishes which would prevent the cracking of the dope layer, of which the flexible nitro-varnish called V.114 was notably successful; ordinary "carriage" or "boat" varnishes were also used.

As opportunities began to occur more frequently of examining old machines, a fact of the highest importance was noticed by several members of the Royal Aircraft Factory and probably by dozens of officers engaged at home and at the front on inspection and repair about the same time; this was that at whatever points the dope was covered with an opaque layer of paint, such as the number on the tail or the identification circles on the wings, there the fabric retained great strength, although all the unpainted part might tear like paper.

This suggested that the real cause of the weakening was *light*, a conclusion which has been abundantly justified since. The dopes with which these results were noticed were, of course, those made with tetrachlorethane; this compound is decomposed by sunlight, and it was quite possible that the chlorine and hydrochloric acid liberated was the real agent destroying the linen. As time went on and preliminary experimental results came to hand the action of light was seen to be more direct and fundamental, the abolition of tetrachlorethane for other and better known reasons made little, if any, difference to rate of deterioration, and long before the real causes were discovered practical prevention was achieved by a pigmented varnish of a dark khaki shade, known as P.C.10, the effect of which is very srikingly indicated in Fig. 1, which shows the progressive deterioration of varnished and unvarnished doped fabric exposed in the summer of 1916. Treatment and weight were as follows:

Treatment	Mean Weight Grs./Metre²
6 Coats raftite	196
" " " 2 coats V.114	243
" " " 1 coat copal varnish	237
" " " 2 coats P.C.10	236

The frames were exposed on May 24, 1916, four being brought in for strength tests on the 24th of each month following. The strength so obtained is plotted against time of exosure.

Fig. 2 shows the results of a similar series, including undoped fabric, started on January 16, 1917:

Treatment	Mean Weight Grs./Metre²
Undoped fabric	130
Fabric + 6 coats raftite + 2 coats V.114	227
Fabric + 6 coats raftite + 1 coat copal varnish	232
Fabric + 6 coats raftite + 2 coats P.C.10	221

These curves indicate the enormous importance of an opaque covering, this being particularly striking in Fig. 1, as the exposures were started at a period when the destructive force of the sunlight was at a maximum. They also make it abundantly clear that, so far as strength alone is concerned, once the action of light is prevented, doped fabric is capable of sustaining continuous exposure for several years without dangerous weakening.

Rapidity of Deterioration at Different Times of the Year

Towards the end of 1916 routine weathering tests on raftite produced at the R. A. F. showed such excellent concordance when exposed for the same period that it seemed quite probable that reliable values of the rates of deterioration during different seasons of the year could be obtained by their means.

As at least eight test frames (representing different batches of dope) had to be tested every fortnight, a mean of not less than thirty-two actual test strips could be taken for each period, which enabled the statistical error to be considerably reduced. After February, 1917, arrangements were made to expose the frames in comparatively large batches at the beginning and middle of each month. The period of all exposures was three months, a batch of weathered frames being taken in at the same time as a new batch was put out. The frames were exposed on a roof of the Chemical Department of the Royal Aircraft Establishment sloping south and facing the aerodrome.

Failing more accurate data, it was assumed that with a uniform deteriorating influence the decrease in strength would be logarithmic. A flat mean of 1,600 kg./metre was taken as the original strength of the unexposed material and the logarithm of the ratio of this to the strength after exposure was taken to represent a measure of the mean rate of deterioration for the period. The full line on the accompanying diagram, Fig. 3, represents the value of the logs so obtained, plotted against the time of the middle of the three months period, *i. e.*, the height of the curve for a given point of time represents the log of the mean loss of strength by exposure from one and one-half months before to one and one-half months after that date.

The two comparison curves plotted in the same way, *i. e.;* three months' total plotted against mean data, are: Total radiation received on horizontal black surface of Callendar Recorder at South Kensington and the same determined by means of a Wilson radiointegrator at Farnborough, the scale plotted being quite arbitrary in each case.

The similarity of the curves is very striking and affords strong support to the conclusion already arrived at, that deterioration in strength of fabric doped with transparent dope is for all practical purposes solely the effect of sunlight, also that weathering tests done in the winter months are absolutely useless, the rate of deterioration dropping to about one-tenth the summer value.

The most important divergence is the falling off in the rate of deterioration after the point represented at the end of May, which throws the peak of the curve to a considerably earlier date than that of sunlight intensity. This may be reasonably explained by the fact that the deterioration is caused by light of short wave length, which, being more susceptible to scattering by haze than the rest of the sun's radiation, would therefore be correspondingly weaker in late summer; in this connection it may be noted that in 1917 the spring and early summer were exceptionally clear and bright.

The unduly high deterioration recorded at the end of January may have its explanation in the highly actinic light reflected from the snow which covered the aerodrome for long periods about that time.

An examination of the peak of this curve shows that unprotected doped fabric loses about 12 per cent. of its strength in a single *average* English summer day at sea level. The rate would be enormously greater at high altitudes above the clouds.

Comparison of German and English Dope

It is interesting to note that rapid as this deterioration is, in the case of an enemy machine examined it was even worse. This was an Albatross Scout captured practically brand new, as dates stamped on parts of it indicated, in December, 1917. The fabric appeared to be flax, rather coarse, open and highly calendered. It was camouflaged by a complete covering of highly colored hexagons dyed on the fabric before doping. The dope was acetyl without protective varnish.

Pieces of doped fabric from the upper and lower surfaces of the lower wing were stretched on frames and exposed on the roof of the R. A. E. side by side with control frames of raftite, with and without protective varnish. Linen aeroplane fabric was used, and the raftite was of the six-coat grade, then issued in quantity by the R. A. E.

The exposure was started on February 1st and the frames taken in for test on May 1st. The mean deterioration rate for this period given by the curve for the previous year (see Fig. 3) is about one-quarter that for the three months, April 16th to July 16th., *i. e.*, the exposure corresponds to only three weeks of summer weather, nevertheless the effect was surprising. The condition of the German dope was hopelessly bad; the camouflaged dyes had faded considerably, the surface was a mass of tiny cracks, the dope coming off in powder when creased, all elasticity had disappeared, and it may be safely said that the machine would have been condemned for flying long before the exposure was completed.

The raftite, as routine tests lead one to expect, was taut and elastic, it did not crack when pressed strongly by the thumb or even in creasing, the only change detectable being the bleaching of the fabric. The frames treated with protective covering P.C.10 showed no change whatever.

The following table shows the results of strength tests, all test pieces being cut across the wings, *i. e.*, in the warp direction:

		Before exposure		After exposure		
	Wt.	Strength Kg./ metre	Extension %	Strength Kg./ metre	Extension %	% loss of Str.
Albatross, upper surfaces	173	1417	5.7	763	4.3	46
Albatross, lower surfaces	169	1463	7.0	699	4.1	53
Raftite	204	1728	12.3	1374	11.9	20
Raftite + P.C.10	221	1757	13.2	1738	13.2	1

It is difficult to account for the extremely rapid deterioration of the Albatross except by supposing that very inferior materials had been used in the manufacture of the dope. The dyes do not seen to have afforded any protection.

It is interesting to note that the Germans do not appear to have adopted pigment varnish as protection from light, although many recent machines have been pigmented; this appears to have been done with a view to camouflage only.

Experimental Investigations Into the Nature of the Action of Light

Experiments extending over three years and involving thousands of strength tests tend to confirm the conclusion indicated by what has already been stated, namely, that deterioration in strength of doped or undoped linen fabric (sometimes called tendering) when exposed to ordinary service conditions is due to light and to light only, the effect of other agents, *e. g.*, heat, moisture, bacteria, moulds, etc., being quite inappreciable in comparison. It is therefore of great importance to investigate the mechanism by which the destruction is brought about.

As a physical study the problem is beset with difficulties. The material upon which the work has to be done, whether yarn or fabric, being a manufactured article, is exceedingly variable in its properties, a defect greatly enhanced by the exigencies of the war, so that one is driven to the use of statistical results involving either large numbers of experiments or low numerical accuracy.

Again, it is difficult to imagine a more unreliable quantity than sunlight in this country, so that there can be no comparison between two tests unless they have been exposed for an identical period both in duration and date. The only artificial source of light yet used with any success is that of the quartz mercury arc, and this is found to be subject to serious objections. It is not therefore surprising that discordant or even contradictory results are occasionally obtained, and the greatest care has to be used to avoid erroneous conclusions.

The Distribution of Destructive Power in the Spectrum

This was investigated by the direct method of throwing the spectrum of mercury arc on a series of linen threads, using for the purpose a Hilgar quartz spectrograph, kindly lent from the Cavendish Laboratory by Prof. Sir J. J. Thomson.

The method adopted was as follows:

Two photographs of the spectrum to which the linen thread was to be exposed were taken on a ¼-plate in the ordinary way, one at the top and one at the bottom of the plate. The finished negative then had its edge carefully rounded off, after which the whole of the spectrum was covered by a binding of thread, the strands of which were carefully laid close together parallel to the spectrum lines. The thread used was Campbell's No. 70 special machine linen thread which had been washed free from size. As wound on the plate there were almost exactly three threads per m. m., rather over 100 being used to cover the part of the spectrum judged to be important.

The negative was now replaced in the plate holder of the spectrograph and exposed exactly as an ordinary plate, using the threads as a sensitive surface, the plate holder being in its median position.

When the experiment was originally planned, it was hoped that the loss of strength of each thread could be plotted along the spectrum, but this was not practicable, owing to the impossibility of obtaining threads of sufficiently uniform strength, and also to the unexpectedly feeble destructive power of the dispersed light. Fortunately, however, there was available a much more delicate criterion, capable of giving useful results, namely, the observation of which threads broke at the point of application of the light and which broke elsewhere.

Even with the employment of this method, the first two experiments gave completely negative results although the exposure in the second was prolonged for 250 hours. In searching for the causes of the failure, one was soon found in the rapid falling off of ultra-violet efficiency of the mercury arc. A third attempt was therefore made, the conditions of which, as it was successful, will be now described.

The source of light was a Westinghouse Cooper-Hewitt quartz mercury arc, type Z.2B., taking about 3.5 amperes at 200 volts. In order to obtain maximum intensity the burner was arranged parallel to the slit of the of the spectrograph upon which the image of the arc was projected by means of a short focus quartz lense in line with the collinator. A very open slit was used giving lines about 2 m. m. wide at the plate, *i. e.,* covering about six threads. The total distance travelled by the light in air was 75 cms.

The duration of the exposure was 670 hours, at the end of which time the threads were stuck down to the plate with a little varnish at the point immediately opposite that exposed and then cut and tested one by one in order in a Baer thread tester. The breaking strain was recorded, but is of little interest in this particular experiment, the real criterion being whether or not the thread broke on the part exposed to the spectrum. The position of the threads relative to the lines of the spectrum was checked from time to time as the breaking tests proceeded, and the diagram showing the results is given in Fig. 4. The line of circles represents the threads, those breaking on the spectrum being shown black. As the latter occupied about 1/6 the length between the jaws of the thread tester an average of one black circle in six is to be expected in the unaffected regions.

Above the threads are shown the lines of the mercury arc spectrum as a series of columns approximately six threads wide; the heights of the columns represent the relative intensities. In the case of the stronger lines where wave lengths are given, the intensities are those determined by Ladenburg, the others being estimated roughly from the strength of the image in the photographic negative. For reference a curve showing the distribution of intensity in sunlight is included. This is plotted from Abbot and Fowles values corrected for the dispersion of the instrument.

The experiment shows very definitely that the destructive effect of the light form the mercury are of greater wave length than $\lambda = 3660$ A.U. is negligible. As there is a strong line at $\lambda = 4060$ it is perfectly safe to conclude that in sunlight or in a continuous spectrum the destructive effect cannot be serious for $\lambda > 4000$, in other words, visible light has little if any destructive effect. In the direction of smaller wave lengths there appears to be no limit, and it is doubtless due to this that there is so great a disparity between the effects of the direct light of the lamp and that in the spectograph. Thus, at a distance of 45 cms. the direct light caused a loss of about 20 per cent per week, while the mean loss of strength over the whole dispersed spectrum for four weeks was inappreciable.

Some early experiments with the mercury lamp showed that its direct effect on fabric was enormously reduced by the interposition of a piece of window glass. Later it was found that glass did not reduce the effect of sunlight in anything like the same proportion. The explanation of this is that the glass cuts off all rays less than λ 3390, thereby reducing the destructive energy of the mercury spectrum to a much greater degree than that of sunlight which has but little energy below that wave length.

During 1918 an attempt was made to repeat this experiment, using sunlight to give the spectrum. The Astronomer Royal, Sir F. Dyson, very kindly permitted the spectroscope to be mounted on one of the large clock-driven equatorials at Greenwich Observatory; the image of the sun was concentrated on the slit by a quartz lens, and after an exposure from April 25th to May 22d, corresponding to about 112 hours' sunlight, the threads were tested, but although bleaching was very evident, no measurable loss of strength had taken place. This failure was partially explained later when it was found that doped fabric exposed at Greenwich deteriorated at less than half the rate of a control exposed at the same time at Farnborough. A very interesting result indicating that smoke and haze must have a much greater scattering effect on the destructive short wave length part of the spectrum than on the visible part generally. Another attempt was made from May 22d to September 6th, using a rather more sensitive cotton thread instead of linen, but this also gave an entirely negative result, so that the actual distribution of destructive power in the sun's spectrum has not yet been experimentally determined.

The Influence of the Atmosphere Surrounding the Fibres

As ozone and H_2O_2 have long been suspected of being the principal agents in the deterioration process, experiments in which oxygen and water are partially or wholly eliminated are of interest.

The first experiment of this kind consisted in exposing strips of aeroplane fabric to the light of the mercury arc in a box with a quartz lid and comparing their loss of strength when air or hydrogen was passed through the box. It was found that a loss of strength of 20 per cent. in the case of air was reduced to 6 per cent. in the case of hydrogen. The method of experiment has been greatly improved by the use of linen threads instead of fabric strips, so that more test pieces can be taken and several different experiments can be exposed to the lamp at the same time and so can be regarded as strictly comparable.

The procedure consists in winding the thread on glass as in the spectrum experiment. A narrow strip of glass is taken, carrying about 30 test threads, and thick tinfoil is wrapped over the ends so that only the half inch at the centre of each test thread is exposed to the light. Test strips of this kind can be slipped into 15 m.m. transparent quartz tubes in which they can be subjected to any treatment desired, very much more conveniently than in the large box with quartz lid previously employed.

The following is a typical set of results. In this case four sets of threads were used, all being placed in similar quartz tubes. One of these tubes was open at both ends so that air was free to circulate, the second contained phosphorus pentoxide at one end; it was highly exhausted for a considerable time in order to render the threads as dry as possible and then filled with dry air. The third was exhausted to very high degree of vacuum on a Gaede mercury pump with repeated warming and then sealed off. In a fourth was put a control strip of threads completely covered with tinfoil. The four tubes were placed under the mercury arc at a distance of about 23 cms., a thermometer was laid between them which rapidly rose to 59° C. (a temperature which does not usually affect the strength of linen yarn) and then remained steady throughout the exposure. After an exposure of 72 hours the threads were tested and position of break noted, the statistical percentage of breaks between the marks in unexposed threads being about 16.6 per cent.

Thread, Campbell's No. 70, Not Washed

	Mean strength	Percentage loss of strength	Percentage of threads breaking on part exposed
Air (not dried)........	52.2 oz.	34.4%	100%
Air (dry).............	52.3 "	34.2%	100%
Vacuum	71.5 "	10.2%	62%
Check in darkness.....	79.5 "	......	16.6%

The conclusion from these and other similar experiments is that the removal of oxygen from the atmosphere surrounding the fibres very largely reduces, but does not entirely eliminate the destructive action of the light. The presence or absence of moisture does not seem to be important.

Photo-Electric Theory for the Action of Light

It will be seen that there is evidence that ozone or oxygen in some active state is the most important factor in the destruction of linen fibres by light. Lyman ("Spectroscopy of the Extreme Ultra-Violet," p. 67) has shown that light causing the direct formation of ozone in air must have a wave length less than 1850 A.U., and that it is completely absorbed by 1 m.m. of air at atmospheric pressure. It is therefore quite impossible that any appreciable quantity of ozone can be formed by the direct action of sunlight on the air near the earth's surface. How then can we account for the production of ozone on or in linen fibres. A possible explanation has been suggested by Dr. F. A. Lindemann which may be briefly explained as follows:

The most effective frequency ν for ionizing a gas is given by $h\nu = eV$, h being Planck's constant, e the electronic charge and V the ionization potential. If we take $V = 9.0$ volts, the value obtained by Frank and Hertz, we get $\lambda = 1380$, a value agreeing very well with $\lambda = 1350$ according to Hughes (v. Allen, "Photo-Electricity," p. 90), but the energy required to remove a charge e to infinity is the form e^2/kr, where k is the dielectric constant of the medium* and r the radius of the molecule, so that the most effective wave length in a medium of dielectric constant k will be k times that in oxygen itself, of which the dielectric constant is nearly 1. Hence, if we can determine k for linen fibres, the most destructive region of the spectrum can be roughly predicted.

A direct determination of k is impossible, but since it equals the square of the refractive index, it can be calculated if the latter is known. By the method of immersing the fibres in liquids of various refractive indices a value for linen fibres of 1.53 has been obtained. From this $k = 2.34$, which gives a wave length $\lambda = 3{,}230$, in good agreement with the actual results given above.

It will be seen that this special reasoning only applies to molecules of oxygen which are actually in close contact with or absorbed by the fibres. Such molecules would be exceedingly difficult to remove entirely by pumping or washing with another gas, so that a possible explanation is supplied for the incomplete immunity found in a vacuum or an atmosphere of hydrogen.

Methods of Protection of Fabric from Sunlight

Dyes

At the time the investigation of the best method of protection was started, owing to the failure of earlier attempts (a failure possibly due to the presence of tetrachlorethane), it was not thought possible to pigment a dope without spoiling it. Dyes were therefore experimented with, and out of about 150 soluble in dope about half a dozen gave promising results, of which two blacks and one yellow gave practically perfect protection and did not fade. Raftites containing only 1 per cent. of such dyes gave a decrease in strength of less than 15 per cent. over twelve months' exposure, *i. e.,* were as good as the best P.C.10, and had strength alone been of importance, dyed dopes would have been strongly advocated, but tautness was equally so and the possibility of its deterioration being also due to the action of light (and therefore to be minimized by dyes) was not realized. In addition, Dr. Ramsbottom discovered that raftite (which contains no tetrachlorethane) could not only be successfully pigmented but that such pigmentation enormously improved the qualities of the dope as regards tautness (v. Figs. 9 and 10).

Pigments

The most important properties of a pigment used for protection either in a varnish or a dope are (*a*) it must have a high extinction coefficient for the actinic light, (*b*) it must be capable of extremely fine grinding, for it is obvious that a given weight of pigment will cover an area direcly proportional to its fineness, (*c*) it must be chemically inactive to any of the constituents of the medium. The natural oxide of iron, known as ochre, which was one of the first tried at Farnborough, possesses all these properties to a notable degree, and when in addition one considers its cheapness and the fact that by the addition of a little lamp-black it yields a khaki shade, it is not surprising that its use as the main constituent of pigmented varnishes and dopes is almost universal. For tropical work aluminum has much to recommend it.

Tautness and Its Measurement

Tautness of doped fabric is important in a great variety of ways. Aerodynamically it is essential to reduce the sag to certain limits, but it is probable with the materials now in use that any surfaces deteriorating to a slackness sufficient to affect the aerodynamical properties of the machine seriously would have been condemned long before on their appearance, though with sufficiently elastic and extensible material this might not be the case.

Appearance is actually a very important consideration indeed. One cannot expect a pilot to view with favor a machine with its fabric hanging in reefs, however good it is in other respects, also slack fabric when in flight, and particularly when exposed to the slip stream of the propeller, may get into a state of flutter, the violence of which may tend to increase and lead to its complete collapse.

(*To be concluded*)

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*As the distances with which we are concerned here are comparable with molecular interspaces, k will not have its ordinary statistical meaning, but its numerical value will probably not be very different.

REPORT OF LATEST CONGRESSIONAL INVESTIGATION OF BILLION DOLLAR AIRCRAFT EXPENDITURES

Approximately ten thousand printed pages are covered by the minutes of the hearings of the latest Congressional investigations of the military aircraft expenditures, which totalled to over one billion dollars since 1917. *It is not surprising, therefore, that the Congressional Committee find it hard to make an adequate report of the situation in less than two hundred printed pages.* AERIAL AGE *is likewise limited by the amount of space available and will be forced to publish only a comprehensive digest of the hearings and conclusions of this latest Congressional investigation of aircraft expenditures.*

The reports of the Frear Committee will be printed first, in full. As regards the Manufacturers' Aircraft Association, this Committee found conditions to be identical with the conditions found by the Senate Investigating Committee summarized in AERIAL AGE *for February 9th and 16th and by Mr. Hughes in his* 1918 *investigation.*

This investigation does not, however, cover the charges of lobbying and other recent alleged pernicious activities of some misguided individuals who have turned Congress against the Aeronautical Movement by their ill-advised actions.

(*Continued from last week*)

Our Aviation Production War Program

Briefly stated, the American Congress during the war appropriated over $1,000,000,000 that was expended for aircraft activities.

Apart from training planes practicaly nothing but a handful of DH-4 "flaming coffins" was produced. The sorely pressed Allies were persuaded to sell us a few largely obsolescent planes, with which we equipped our aviators. In all lines of aircraft production we subordinated speed, immediate needs, and experience to be gained from other nations to "quantity production." Instead of inviting all agencies to aid, the War Department engineering "experts" jealously refused intelligent and experienced help. These experts during the war tried to develop an automobile engine and fit it into all types of aircraft. The result was an impossible program that for a year and a half awaited the experiments of military engineering experts. Battle or pursuit planes would not have reached quantity production in 1919, judging from past experience in 1917 and 1918 and with a scarcity of planes possessed by our Allies every gift or sale by them was at a tremendous military and national sacrifice. Inexperience, ignorance of the business, and inefficiency from beginning to end marked our aircraft production program during the war. Our strongest asset was the aeroplane production of our Allies, the splendid fighting spirit of American aviators, and the weakness of the enemy toward the end, for all of which our aircraft production program was in no way responsible.

Waste of the larger part of $1,000,000,000 will not be entirely lost if we have learned a lesson from the past.

Lack of public confidence in War Department aviation plans appears well grounded. America should keep abreast of modern aircraft thought, and invention must not be permitted to lag behind; but the great stumbling block to-day lies in a knowledge by Congress and to a large extent by the country that the War Department has made a mess of America's aircraft program and has not developed any competent head to inspire public confidence.

A Separate Air Service Indispensable

Any investigation to be of permanent value should offer a solution for the problem of intelligent aircraft advancement.

Fortunately, or unfortunately, the striking failure of the War Department to rise to the aircraft emergency, either in peace or in war, has made necessary the creation of a separate bureau or department of aeronautics. Therein all governmental activities should be centered with a capable, progressive official at the head.

Practically every witness examined on the subject of future American air service united in a plea for separate independent control. From generals to lieutenants, from private citizens, familiar with the subject, and from every experienced aviator appearing before our committee, including Gens. Mitchell, Kenly and Foulois, military aircraft authorities, and LaGuardia, Meissner, Kindley and, last but not least, Rickenbacker—men who upheld American air laurels at the front, all unanimously urge a separate air service that will work and co-operate with the Army, Navy, Post Office and Interior Departments in the development of aviation. We feel that real progress in aviation must depend in a material degree upon encouragement given to civil and commercial aviation.

Adequate appropriations, wisely expended, are necessary to put America to the front where she belongs. The imperative necessity for this policy must be apparent to all who have studied the constantly increasing scope of aeronautics. Cooperation with and encouragement to inventors and manufacturers and a broad, intelligent policy is demanded. Practically all other countries have adopted that course, and ours must not fail at this crucial period to do so.

The future of aviation is beyond our present dreams or understanding, and our Government must do her full part in leading in its development.

Expenses of This Congressional Investigation

Your committee has worked hard and faithfully for over six months and submits the record, without apologies, for whatever its value may be.

The committee of 15 selected to investigate War Department expenditures possesses no member, Republican or Democrat, who desired the thankless task that entailed hard work without reward. Once appointed, however, it became a public duty that could not be avoided.

This comment is offered in conclusion because the committee of fifteen was brought into being by a unanimously adopted resolution of the House and every Member has direct responsibility for its existence. Members of Congress get their commission direct from the people, and in any painstaking congressional investigation of public expenditures the facts are sought and given to those who ultimately pay the bills. Critics who question the expense of investigations are often influenced by motives other than public money expenditures, but they are here reminded that dircetions to incur such expense came from a unanimous vote of the House, and, as we understand, all expenditures of the five subcommittees combined will not equal much more than the cost to the Government of 1 mile of the Lake Crescent Railroad, or 1 mile of the Newport Railroad, or of the Alsea Railroad. All the combined five subcommittee expenditures presumably will not equal 5 per cent of the cost to the Government of the Siems-Carey sawmill folly, or 2 per cent of public money wasted on the worthless Bristol plane. Your subcommittee on aviation has tried to perform its duty and offers the record as an evidence of how little was realized by the Government from $1,000,000,000 ostensibly expended for aircraft.

The committee has endeavored to present a temperate, unbiased report devoid of sensationalism, which is sustained in important essentials by the reports of Justice Hughes and the Thomas Senate subcommittee. The facts have been presented squarely without inuendo and responsibility has been lodged against those in positions of authority. Pages of record on which such testimony appears has been cited with names of witnesses. This was our commission from the House, and it has been faithfully performed.

Experience in prior investigations has disclosed whitewash reports and efforts to smother or discredit anything reflecting upon the War Department. In an effort to distract public attention from the findings of fact reached by Justice Hughes and the Thomas committee, as stated at the outset of this report, apologists for indefensible inefficiency and extravagance may seek to mislead public opinion and endeavor to confuse the situation by reflections upon the committee which was unanimously selected by the House to get the facts. Such methods, if pursued, strikingly illustrate a course of procedure adopted in responsible quarters of trying to minimize anything affecting the Air Service, War Department, or administration. No honest or reputable Member of Congress can afford to take the position and your committee presents the hearings, testimony and report as conclusive evidence in support of the findings submitted.

If from the record we may find helpful suggestions regarding pitfalls to be avoided and a solution for the permanent advancement of aeronautics, then the money, time and labor expended by your committee will not have been in vain.

NAVAL and MILITARY AERONAUTICS

Fog Hampers Army Alaska Planes

Wrangell, Alaska.—Aeroplane No. 4 of the United States Army's Aerial expedition, returning to New York after a flight to Nome, Alaska, arrived at Sergeif Island, ten miles from Wrangell, according to late reports.

Three planes of the expedition encountered fog in attempting the flight from White Horse, Y. T., to Glenora, and were forced to return to White Horse.

Naval Aircraft to Participate in Pacific Fleet Manoeuvres

When the Pacific fleet moves south the latter part of this month, and concentrates for several days of battle manoeuvres and target practice, there will fly with it a great air fleet comprising every known type of aircraft. In this air fleet will be some of the navy's newest and latest aerial fighters—the torpedo planes. The Fleet Air Detachment possesses several squadrons of these new air weapons and will have an ample opportunity to test their merits during the coming manoeuvres, which will mark their first appearance at such an engagement.

Seaplanes will carry on raids and bombing sorties against the seacraft simultaneously with the torpedo attack. Fast scout planes, carried on the decks of the big ships will attempt to outmanoeuvre and drive away the big and less speedy enemy which will also be protected in their raids by agile scouts.

The sham battle will develop into one of sea power versus air power. The outcome of these tactical manoeuvres between fighters of the sky and fighters of the sea is at present problematical. If the torpedo-planes aided by the huge seaplanes and protected by speedy scouting planes can bewilder the anti-aircraft and ship planes, and thereby destroy the battleships, it will conclusively demonstrate the potency of the aerial fighter and bring it to the foreground as the future main arm of defense.

The combined Atlantic and Pacific fleets will assemble off Panama after the first of the year, to engage in the great annual battle practice and manoeuvres. Seaplanes, including torpedo planes, land planes, dirigibles and kite balloons will be used to a greater extent than ever before.

Aerial smoke bombs will be dropped from the sky to form a curtain of protection for the dreadnaughts against the more mobile cruisers and destroyers. Aerial torpedoes will be launched from planes swooping down from above.

In both manoeuvres, that of the Pacific fleet alone the latter part of this month and that of the combined American fleet off Panama, the deciding factors will turn out to be the aircraft.

Navy Pilot Selected for Balloon Race

Trial flights of Navy balloons in preparation for the national race were held on Sept. 4 at Akron, Ohio. Lieut. (J. G.) Raffe Emerson, U. S. N. R. F., was selected as Navy pilot. The balloon was a regulation 80,000 cubic feet free balloon. The national race is an elimination contest for the purpose of selecting three entries for the international contest, and it will be held at Birmingham, Ala., Sept. 25. The international race will start from some point in the United States during the latter part of October, details to be decided after the elimination trials. The Aviation Section of the Navy Department is making every effort to develop a Navy balloon capable of winning in both the national and international events.

Tests for Army Commissions

Washington.—Competitive examinations will be held from October 25 to 31, inclusive, to fill 200 vacancies in the army commissioned lists, ranging from second lieutenant to major, the War Department has announced. These vacancies were reserved for those unable to appear at the previous test.

Seaplanes Aid Fishermen

Washington.—As a result of patrols maintained by naval seaplanes, Chesapeake Bay fishermen are making the biggest hauls on record. Reports at the Navy Department from the Commandant of the naval air station at Hampton Roads said the patrols had proved "indispensable" to the fishing industry in those waters.

Immense schools of fish are spotted almost daily by the seaplanes, it was reported, and fishing fleets are given the location by radio communication or, if within sight, by flag signals.

Torpedo Plane Sets New Navy Speed Record

Carrying a crew of four men and a 1,600-pound torpedo, a Martin bombing plane fitted with torpedo gears recently flew from Washington to Yorktown, Va., a distance of 125 miles, in 64 minutes. Naval officers declare the flight established a record for planes of that type.

The flight was made as a test of the Martin plane in connection with its use in the bombing and torpedo practice soon to be conducted with the old battleship Indiana as a target.

Aviation Station at Guam

The Navy Department is assembling aviation material for the proposed air station on the island of Guam. Capt. G. W. Martin, U. S. M. C., who has been designated commanding officer of this new activity, has completed the advanced course of flying at the Army Air Service Pilots' School, Carlstrom Field, Arcadia, Fla.

Balloon Telephone Experiments Made

A very interesting experiment is being conducted at the Army Balloon School, Fort Omaha, Nebraska, with a single conductor loud talking balloon telephone. This telephone has only a single conductor. It is being designed in the experimental laboratory at Fort Omaha for balloon use and will eliminate all wires from the balloon to the ground, including the reel cart on the ground. The single conductor being experimented with is the balloon cable itself.

The set is made to connect on each end of the balloon cable, and connections provided for the chart room or for any standard telephone system.

Very satisfactory conversations have been carried on at an altitude of 800 meters. The voice from the ground can be easily understood at a distance of from four to five feet from a single receiver.

The telephone does not involve any of the transmitting principles of radio telegraphy, and cannot be heard with wireless receiving apparatus. The single conductor telephone is being perfected and offers a wide field for experimental work and a great many possibilities.

Officers Transferred to Air Service

Special orders No. 188-O, War Department, dated August 11, effects the transfer of the following officers, regular army, from Infantry to the Air Service:

Lieut. Col. Ira F. Fravel and Majors Jacob W. S. Wuest, Barton K. Yount, Henry H. Arnold, Henry B. Clagett, John F. Curry, Jacob E. Fickle, William J. Fitzmaurice, Benjamin D. Foulois, Alfred H. Hobley, John W. Simons, Rush B. Lincoln, Ira Longanecker, Henry C. K. Muhlenberg, William F. Pearson, William E. Gillmore, Harry Graham, Harry W. Gregg, Roy C. Kirtland, John D. Reardon, Albert L. Sneed, John S. Sullivan.

Aviation Training for Naval Reservists

Improving the opportunity of Naval Reserve officers in Class 5 to take flying training is a question now before the Navy Department. It is likely that facilities for flying will be provided for Reservists at the naval air station at Anacostia, D. C., and at the Great Lakes naval training station in the near future. The matter of giving preliminary training for young men who desire to enter the Reserve Flying Corps is also under consideration, and a syllabus is being drawn up for the technical schools and colleges which may decide to add aviation to their curricula. Four seaplanes were sent to Baltimore for a week-end to allow Reservists air training, and the plan proved so successful that the Baltimore Aero Club has requested the Navy Department to continue the practice.

Plane to Land on Mt. Rainier

What will be the highest altitude at which an aeroplane ever made a landing will probably soon be attempted by an Air Service pilot. Forest patrol flyers have reported a long, flat ice-field on the top of Mt. Rainier, Washington, at a height of 14,000 feet, and have requested permission from the San Francisco office of the service to make a landing on the field. According to San Francisco officers of the Air Service such a landing will entail unusual difficulties. Because of the rarefield atmosphere the plane will have to be driven to the ice-field with the throttle wide open. In leaving the field, owing to the lack of buoyancy of the air at that altitude, the pilot will have to allow for his plane dropping several hundred feet down the side of the mountain.

FOREIGN NEWS

London-Paris Route More Popular

The passenger traffic on the air route between London and Paris is steadily increasing.

During the month of July 933 persons so travelled, making a daily average of 30 passengers. The continuous increase in traffic is brought out by comparison with the number of passengers carried in February, 102; March, 183; April, 198; May, 450; June, 775.

Plan Aerial Mail in Sweden

An application has been made by the Swedish Postal authorities to the Government for permission to establish a regular aerial mail between Malmoe and Berlin, *via* Warnemuende. It is proposed that the service be maintained by German pilots on Junker machines, and it is stated that the consent of the Allies to this has been granted for a period of three months.

Italians in Peru

An Italian-Peruvian aerial navigation company has been organized at Lima with the object of developing aviation in Peru. It proposes to run a regular service between Lima and Iquitos in the Amazon region, and the starting of further services depends upon the provision of landing grounds and hangars. A flying school will be established near the capital and the equipment will consist of Caproni machines.

London to Switzerland

The Lep Aerial Travel Bureau announces that a Handley Page machine, carrying ten passengers, left London recently, for Switzerland. The fares are £21 single and £37 10s. return. The journey takes about six hours, less than a quarter of the time taken by the train and boat, while the cost is little more than double the first-class rail fare.

A Flying Royal Family

King Albert's children share his interest in aviation. Princess Marie José recently made her first flight. The King was present at the flight, which lasted 30 minutes, to the great enjoyment of the princess.

Aerial Service to the Leipzig Fair

The Rumpler Company is running a regular aerial service in connection with the Leipzig Fair between Berlin (Johannisthal) and Leipzig. They are also giving flights round Leipzig itself and in the neighborhood.

Sir Ross Smith's Plans

Captain Sir Ross Smith will leave for London this month to complete the arrangements with Messrs. Vickers for a flight round the world.

Big Load on Cross-Channel Flight

The Vickers-"Vimy" aeroplane, "City of London," of the Instone Air Line, arrived in London from Paris recently with 15 passengers on board, 12 of whom were ladies; 400 lbs. of goods were carried in addition.

Italy and the Schneider Cup

The Italian contingent will consist of the following firms:—S.I.A.I., of Sesto Calende, and Nieuport-Macchi, of Varese. The machines they intend to enter are, respectively, two S19 and two M19 seaplanes.

War Trophy Zeppelin for Paris-Africa Line

Paris.—Having no practical use to which it can put the second Zeppelin to be handed over to France by Germany, the Government has negotiated its sale to an important aerial enterprise. The purchase price, it is said, is 3,000,000 francs ($600,000 normally).

M. André Michelin, President of the Aero Club of France, who is co-operating enthusiastically with the Committee organizing the Round-the-World Aerial Derby. M. Michelin is a Chevalier of the Légion d'Honneur

Peer Pilot Flies with Bride from London to Paris

London.—Widespread interest was shown in the marriage recently of Lord Montagu, of Beaulieu, to Miss Pearl Crake, daughter of Col. E. Barrington Crake, in the Parliamentary Church, St. Margaret's, Westminster.

They are now in Paris, having gone there from London by aeroplane, Montagu acting as pilot part of the way.

Lord Montagu has been a pioneer in motoring and flying in Great Britain, is an expert mechanician and has driven the locomotives of the fastest expresses in Europe. During the war he was torpedoed in the Mediterranean, having what seemed to be a miraculous escape, turning up safe some days after his obituary had been printed in every newspaper in Great Britain.

Montagu devised and carried out a scheme during the war for mapping, by means of air photographs, the whole of England, a fleet of planes working from his own estate on the borders of the New Forest in Hampshire.

Paris to Algiers Air Line Starts in 1921

Paris—A dirigible airship passenger service from Paris to Algiers is planned for the spring of 1921. The ministry of aerial transports has issued a license for the company, which is building two large dirigibles of the rigid type, capable of carrying thirty passengers each.

Aeroplane to Carry Troops and Guns

London.—The British government's experiments with aerial troopships at an aerodrome near London have proved a success, it was learned today. They were conducted with great secrecy under the direction of Secretary of War Winston Churchill.

The aerial troopships are aeroplanes of unprecedented size, built by the Vickers, Limited, the company which constructed the Vickers Vimy, the aeroplane in which the late Capt. Sir John Alcock and Sir John Whitten Brown crossed the Atlantic Ocean.

The Air Ministry refused to permit any indication to be made of the description of the super-aeroplane with which the experiments were made, or the number of men it carried.

According to reports the Air Ministry planned aeroplanes big enough to carry light artillery as well as troops.

An Italian School in Argentina

It is stated that an Italian company has organized a flying school at Buenos Ayres, and has appointed Capt. Laureati, a well-known Italian pilot, as director.

Record London-Copenhagen Flight

From London to Copenhagen in 6 hrs. 5 mins., flying time, was the record established by Lieut. Vaughan Fowler recently in a DH-9 aeroplane. The machine, with one passenger, left the Handley Page Aerodrome at Cricklewood at 12.10, reached Amsterdam at 2.15, and at 3.45 restarted for Copenhagen, where it arrived safely four hours later.

The machine was for the North-West European service, organized by English, Dutch, German, Danish and Swedish companies. The Copenhagen-London service is flown on Tuesdays, Thursdays, and Sundays, the return journeys being made on Mondays, Wednesdays, and Fridays.

Germans Give Zeppelin to Japan

Berlin.—Japan will receive the latest and best equipped of the Zeppelins from Germany. The giant airship is now being taken apart and, together with its hangar, will be shipped to Japan within a fortnight.

The Germans appear to have purposely reserved this model for the Japanese after delivering to England, France and Italy their share of the German Zeppelin fleet as compensation for destroyed ships.

The Japanese are known to be looking around for a German crew to put the ship together when it arrives in Japan, as well as show the Japanese how to run it.

The Italians, who received their Zeppelin, confess they do not know how to operate its motors, and will require the advice of the German constructors. The crew which landed the ship at the Campino aerodrome, just outside of Rome, was received with bands of music and feted the entire day.

It was the first time a Zeppelin has crossed the Alps.

Tracked from the Air

Robbers who stole a safe containing 20,000 francs from Istres aerodrom, France, were tracked by aeroplane. The safe was recovered, and three soldiers, who confessed they were guilty of the theft, arrested.

Woman Pilot's Channel Flight

Mlle. Boland left St. Inglevert at 8:40 on August 11, intending to fly to Croydon, but was obliged to land at Le Crotoy owing to bad weather. She was flying a Caudron aeroplane. Contining her journey, she lost her way and landed in Belgium. She left Brussels on the afternoon of August 14, and reached Páris on August 15 (still en route for Croydon?).

Aviation in Burma

It is reported in Burma that Aeroad (Burma), Limited, have received orders for five new aeroplanes from well-to-do young Burmans. It is hoped to start a daily aerial service between Rangoon and Bombay via Calcutta in the near future.

Aeroplane Services for Mauritius

Irregular arrivals of mail boats from Europe via Madagascar and Réunion and the shortage of coastal shipping has induced a number of Mauritian traders to finance a company for the inauguration of an aerial service to connect Maritius with Madagascar and Réunion, on the one hand, and with Seychelles, Rodriques, and the Oil Islands, on the other. The moving spirit in the new venture is Mr. Anthony Colin.

Developments in Australia

A Boulton-Paul 100 h.p. aeroplane has just made a flight from Sydney to Melbourne in 6 hours, 37 minutes. Another machine has accomplished the first direct flight from Sydney to Brisbane in 7 hours 24 minutes.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

Light Machines at High Altitudes

Air grows less dense as you climb in an aeroplane and an engine loses power, so that a height is eventually reached where the motor can not give more power and the aeroplane ceiling is reached.

We will say, for example, that an aeroplane has a ceiling of 3,000 feet which is a good bit for a machine of say 25 horsepower. This would be so if the machine were to fly from a field that was located at sea level.

Now suppose the country some of our readers live in is 2,000 feet above sea level. Then the above machine would climb only 1,000 feet above the ground at that point and the engine would not develop its rated horsepower, even on the ground.

The reason a motor does not develop its full horsepower at high altitudes is because the thinner air when compressed in the cylinder does not have the same density and the compression is much less than it would be at sea level with the result the explosion has not the same effect on the piston.

To overcome this, super chargers are installed on some aeroplane motors. It might be worth while to describe a super charger.

A super charger is a contraption that compresses the air and packs it into the cylinders at sea level pressure. Of course, a proper amount of gasoline is mixed with the air to give the proper explosive charge.

The wings of an aeroplane having a certain area and driven at some known speed will not lift as much in the thin air as they will at sea level.

Other interesting facts are that the resistance at a certain speed is much less at high altitudes than at sea level, and a propeller turning 1,000 r.p.m., having a 6 foot pitch, will not give the same thrust at a high altitude as it will at sea level.

The facts outlined above must be known and remembered when a design for an aeroplane is worked out and especially so by the designer of the motorcycle engined or Ford motored aeroplane.

These little machines would not be able to get off at altitudes of 1,000 to 1,500 feet, as the ceiling of the first mentioned machine is around 1,000 feet.

Electric Motors in Aeroplanes

Once in a while a reader will ask if it is not practical to use an electric motor in an aeroplane either the full size or the model.

An electric motor is heavier per horse power than a gasoline motor, so much so that the weight is greater than the aeroplane could lift, and then considering the storage battery for driving the motor, the weight would be beyond reason.

It has been stated by someone that a model has been flown with an electric motor.

I do not believe that this is so, because the lightest electric toy motor that can be built to drive a 12″ propeller weighs about 10 ounces. The battery necessary to drive this motor would (at the lightest weight it could be made) weigh 8 ounces. This would be too heavy, and a model with a wing spread great enough to sustain the weight of the power plant and frame construction surely would not fly from the energy of a 12″ propeller.

I think that the model builder who claimed a model did fly with an electric motor was overcome by his enthusiasm, and what really did happen was, the model, after being launched from the hand, made a long, graceful glide, which was lengthened by the little help from the 12″ propeller, and the aeromodelist forgot this and claimed a flight.

The general flight of a scale model is short, and most times at heights no greater than six or eight feet from the ground. Many are made in a long glide, starting from the hand and making what is really a glide to a point some hundred to one hundred and fifty feet away.

Some electrician may at some time make a motor of enough power and lightness to be used in an aeroplane, but at present there is nothing that can be used for such work.

To Figure the Area of Model Surfaces

For long distance racing model aeroplanes the loading should be light, that is, not more than 8 ounces per square foot of main supporting surface.

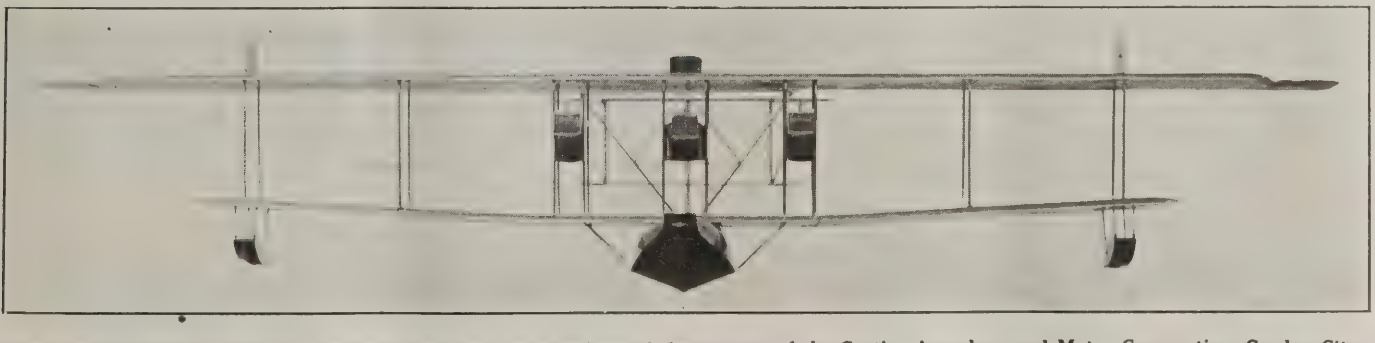
In order to get this extreme light weight it is necessary to make the parts of as small cross sectional area as possible. The frame or fuselage should be carefully thought out and designed and made with extreme care. The two spars in an "A" frame construction should be of maximum cross section in the middle and tapering to the ends. To brace it a post or pylon is fastened to the middle cross brace, and wires attached to each end and resting on this brace.

The planes should be made of bamboo split to 1/16″. These are the ribs and the edging. The spars must be no heavier than ¼ x 1/16″ wood. The wings are double surfaced and gold beaters skin is used for covering. The propellers are mere shells and the rubber motor consists of only as much rubber as is necessary to rotate the propellers fast enough to drive the machine slowly through the air. The amount of rubber can be determined by starting with very little and adding rubber until the necessary amount is used or starting with too much and gradually cut it down until there is only enough to fly the model.

For scale models the weight per square foot can be greater, ranging from 8 to 30 ounces per square foot, of course keeping the weight down as much as possible; for instance, if a model could be so constructed as to weigh only 15 ounces it would not be wise to let it go up to 18 or 20.

The construction, however, is not as frail as for the racing type, and cannot be, because a scale model must be made to the shape and general form of its prototype and must resist hard landings, something to which scale models are subjected to most of the time.

Water models, that is, any that have floats or pontoons on, must weigh the same as long distance racing models, with the addition of the floats, which, if made of thin sheets of wood, say, 1/32″ thick, glued with "Ambroid," which is a waterproof glue, will be really light in weight. Or, better yet, carve them out of Balsa wood, then gouge them out and cover with silk and dope to make watertight.



Wind tunnel model of the NC-4 Seaplane, built by the experimental department of the Curtiss Aeroplane and Motor Corporation, Garden City, Long Island, N. Y.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

To Fly!

Serene its poise, 'midst fleecy clouds on high—
I walk its decks,—way up here in the sky,
And feel the steady tremble, 'neath my feet
Of massive engines in their ponderous beat—
Propelling through the air, this mighty ship,—
Since ere I left its earthly slip.

The scenes are wondrous,—I declare,
High up in space—out here, in air;
It seems to be the last plan of man,—
Completing God's work,—since Time began.

To fly—to fly, to fly, to fly!
Ah, that's ever been in the heart of you and I.

CHARLES L. PRYAL.

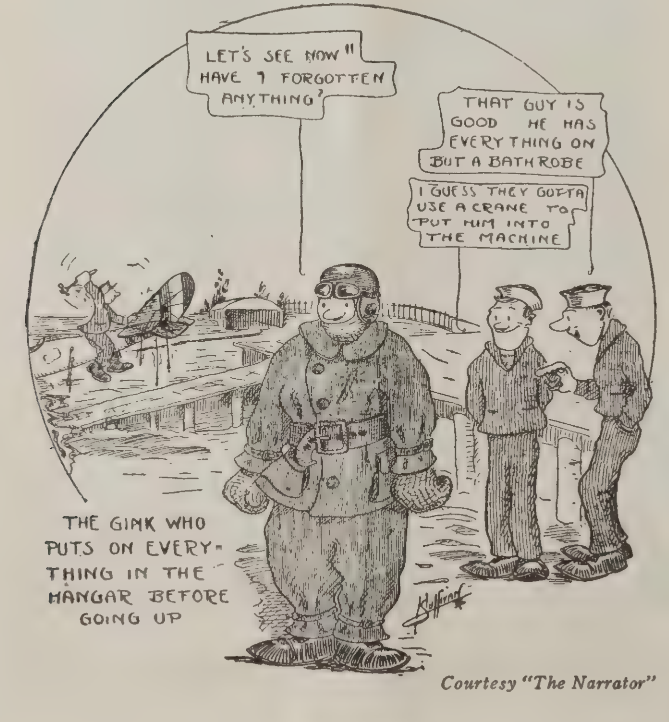
Sure of Himself

Employer—"Do you consider yourself a good salesman?"

Former Mess Sergeant—"Say, I could sell Fords in Venice."

Here is a Puzzle

A sailor went into a restaurant with his girl, and after they had eaten, their bill amounted to $3, but the sailor only had $2. He needed $1 more to pay the bill. So, leaving the girl in the restaurant as security, he made his way to a pawn shop, where he pawned his $2 for $1.50. Then, taking the pawn ticket, he sold it to a pedestrian for $1.50, altogether making $3; so he went back and paid his bill. Now, we want to know, friend reader, which one of the trio lost the extra dollar?


LET'S SEE NOW!! HAVE I FORGOTTEN ANYTHING?
THAT GUY IS GOOD HE HAS EVERYTHING ON BUT A BATHROBE
I GUESS THEY GOTTA USE A CRANE TO PUT HIM INTO THE MACHINE
THE GINK WHO PUTS ON EVERYTHING IN THE HANGAR BEFORE GOING UP
Kuffner

Courtesy "The Narrator"

No Doubt About These Orders

All was rush and bustle in the studio when the new producer began to get busy. He snapped and barked and roared and wept, but certainly he got things done.

Then he turned suddenly to the weary "star," who was resting after the last stunt.

"We'll begin on the next episode now," he said briskly, while the actor groaned. "It ought to be a thriller. You're blown up into the air by an explosion, and an aeroplane rushes along and catches you."

"It does, does it?" exclaimed the actor. "But look here, supposing the aeroplane isn't there?"

But the film producer's thoughts were already way ahead. "Oh, that's all right!" he snapped absent-mindedly. "In that case, just come down; don't wait for it!"

McGinty tried to give a lecture on the Bolsheviki-Polish war, and he is now in the Sick Bay with lockjaw.

Do you fully realize that there are several distinct wars going on just now?

The Bolsheviki versus the Poles.
The Bolsheviki versus the Persians.
The Bolsheviki versus General Wrangel.
The Greeks versus the Turkish forces in Thrace.
The Irish versus the English.
The Americans versus the High Cost of Living.
Keep your powder dry and stand by for developments.

Going Up

On the drill field a company of engineers was making the most gruesome possible mess out of "platoons left." A flea-bitten sergeant cast a sarcastic eye over the unhappy aggregation and then turned to the officer.

"Lootnant," he said, wearily, "I guess they thought you said 'balloons left,' so they all went up in the air."

Those Language Americain!

"Mais," protested the Frenchman who was touring the country, "you have admit that you have not see the London nor the belle Paris, yet you have say you have cross the ocean."

"That wasn't exactly what I said," replied the lank West Virginian, "I only told you that I went down to the ocean and give it the once over."

The Speed Boys

Still Buck: "Man, I tell you I'm the fastest guy on record. Many a time I've outrun a bullet for four miles and got away from it clean."

Civvie Again: "Call that speed? Shucks. I can turn out th' 'lectric light and be in bed before the room is dark."

American Legion.

The Fool Killer

"Say, listen," remonstrated the corporal when he came upon the laziest man in the outfit industriously cleaning his rifle. "You better cut that out. You're gonna get hurt."

"What's gonna hurt me?" inquired the laziest man.

"Accidental discharge of duty."—*American Legion.*

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SEP 27 1920

AERIAL AGE
WEEKLY

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Courtesy of Capt. H. S. Broad

Airscape of the West Pier, Brighton, England

Are You Pushing the Extension of the Aerial Mail Service?

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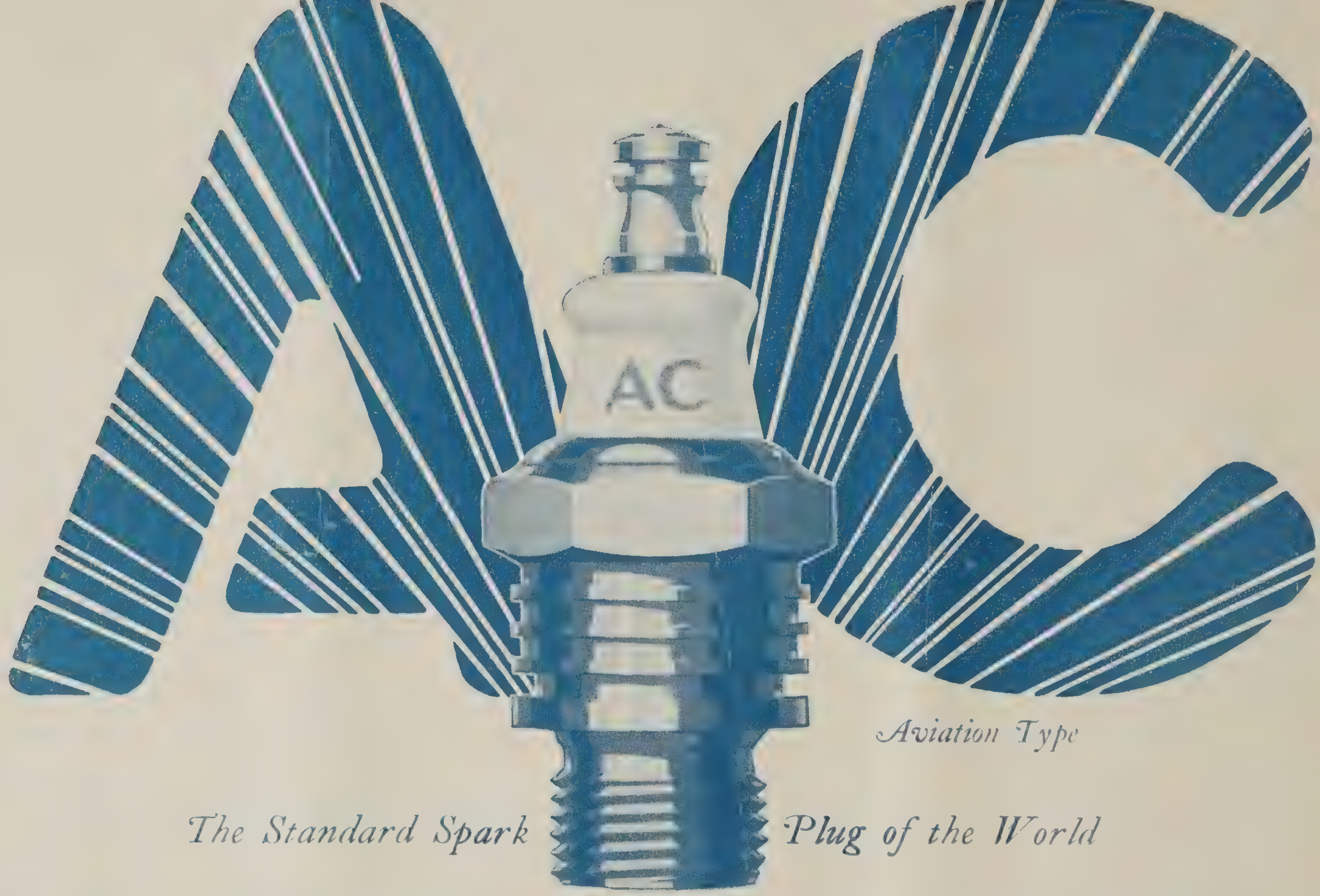

Aviation Type

The Standard Spark Plug of the World

The cost of airship engines prompts owners to seek every possible method of prolonging motor life. Experienced airmen know that faulty ignition brings rapid depreciation and inefficient performance, with attendant perils. Consequently they demand AC Spark Plugs, knowing that AC's function perfectly, assuring long engine life and insuring the pilot's safety.

Champion Ignition Company, FLINT, *Michigan*

These Manufacturers Factory Equip Their Products With AC Spark Plugs

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Robinson Fire App.
Rock Falls
Rowe
St. Cloud
Sandow
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Signal
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Titan
Tower
United
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Walter
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Briggs-Stratton Motor Wheel
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Avery
A & T
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Beeman Garden
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Buffalo
Bullock Creeping-Grip
Case
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O. K.
Oldsmar Garden
Pioneer
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SpryWheel
Stockton
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Delco-Light
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Fairbanks
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Globe Light & Power
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Ingersoll-Rand Air Compressors
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Perfect Power Sprayers
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Wade Drag Saws

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VOL XII. NEW YORK, SEPTEMBER 27, 1920 No. 3

ARE YOU PUSHING THE EXTENSION OF THE AERIAL MAIL SERVICE?

THE Aerial League of America has the right idea. Instead of joining the procession of mourners who lose time bemoaning the fact that Congress will not give hundreds of millions to be spent in aeronautics, the League proceeds with a plan to popularize aeronautics by establishing a section of the League in every community and thereby creating extensive public use and demand for aircraft and pushing the extension of the Aerial Mail Service.

During the past three years, while AERIAL AGE and *Flying* conducted expensive campaigns on behalf of the Aerial Mail Service, the Aerial League of America was the only other national organization that was willing to support and popularize the Aerial mail by sending thousands of letters by aerial mail. At that time the special 24 cent, 16 cent and 6 cent stamps were required for the Aerial Mail and, furthermore, it required the aggressive and progressive attitude of national leaders like Admiral Peary and the other officials of the League to urge civic authorities and business organizations throughout the country to ask Congress for an extension of the aerial mail service and to call on Congressmen who opposed aerial mail appropriations and make them realize the importance of developing the aerial mail service as a means of keeping up our national aerial activities after the war.

Well do we recall how Congressmen in 1918 would ask: "If the expenditure of one billion in military aircraft is not placing the United States at the forefront aeronautically, we cannot see how an appropriation of a few million dollars for the Aerial Mail will make any difference!"

Thanks to the efforts of Postmaster General Burleson, Second Assistant Postmaster General Praeger, and their able assistants, supported by the powerful work and contributions of the Aerial League of America and other co-operating organizations throughout the country, a start was made in establishing the Aerial Mail service in 1918 and progress was made in rapid strides in 1919.

During the past year Congressmen have refused to give larger appropriations for the extension of the Aerial Mail service, principally because of the pernicious lobbying of few employees and members of the so-called "Manufacturers Aircraft Association" who, as explained at length in AERIAL AGE for February 9th and February 16th, created antagonism against aeronautics by their pernicious activities and highhanded attempts to secure unwarranted subsidies for a few individuals, whose activities had already been condemned by the U. S. Senate investigating committee as **"vicious and designed to reap large profits by taking advantage of the necessities of the government,"** Congressmen did not know that this "association" does not represent the aeronautic industry.

Fortunately the Aerial League of America under the able leadership of Admiral Peary, who conducted the national activities of the League from the Washington headquarters, had established a high reputation, and Congressmen did not hesitate to accept the League's opinion and recommendations.

High Officials Send Greetings to Aerial League Via Trans-continental Air Mail

Among the high officials who have sent greetings to Mr. Henry Woodhouse, acting president of the Aerial League of America, via transcontinental air mail are: Governor James E. Cox, of Ohio, presidential candidate; Major General Leonard Wood; Major General J. T. Dickman, Commander Southern Dept., U. S. Army; Major General Hunter Liggett, U. S. A. Commander, Western Department; Hon. Frank O. Louden, Governor of Illinois; K. M. Turner, president Aero Club of Southern California; George B. Harrison, secretary and treasurer of the Aero Club of Southern California; John R. Gammeter, president and Rex Uden, secretary of the Associated Aviation Clubs of Ohio; J. C. Irvine, director Pacific Aero Club; Governor Bamberger of the State of Utah; Charles W. Fay, Postmaster of San Francisco; V. E. Stephens, vice-president Aero Club of Illinois; Colonel Biron J. Arnold, Chairman Chicago Air Board; A. Leo Stevens; Major William C. McChord, Department Air Service Officer, Central Department; Captain Henry C. White, U. S. A., commanding Omaha Balloon School; J. M. Patterson, editor Chicago *Tribune*.

Progressive, Enthusiastic Attitude of Postal Authorities Secret of Aerial Mail Progress

The secret of the aerial mail progress has been the progressive, enthusiastic attitude of the postal authorities, backed by substantial vision and energetic efforts. Those of us who have co-operated with the Post Office Department know that Postmaster General Burleson, Second Assistant Postmaster General Praeger, and their efficient staff have overcome every obstacle in the way of the aerial mail service by sheer progressiveness, hard work, pioneer spirit and unbounded faith in the ultimate great value of the aerial mail service to the country and to the general development of aeronautics.

That their splendid spirit is shared by the postmasters through the country is shown by the letters received by officials of the Aerial League of America, of which the following, addressed to Mr. Henry Woodhouse, by the Postmaster of San Francisco, is one:

OFFICE OF POSTMASTER, SAN FRANCISCO, CAL.
September 11, 1920.

Mr. Henry Woodhouse,
President, Aerial League of America,
280 Madison Avenue,
New York, N. Y.

Dear Sir:

With glee and unbounded gratification, I return you enclosed envelope, which was received in the first aerial mail arriving in this city from the metropolis of the world.

As stated in your letter, which this envelope enclosed, it is truly a wonderful age in which we live, and I fear that we are not fully appreciative of the great events in history making in which we are engaged.

In reviewing the advances made in mail transportation from the days of the pony express, accompanied by its many hardships and trials, and which gave heart and encouragement to the joining of the West with the East, down to this wonderful event which occurred today, in the reception of the first aerial mail, we seem to have accomplished almost the incredible.

This mail received today, which in elapsed time figures eighty-three hours, but in actual flying time hardly more than forty hours, certainly marks the elimination of time and space between the two rims of our country.

The persistent, earnest, and successful efforts of your organization contributed very much toward this great accomplishment and has earned the warmest thanks of all your Western brothers.

Very cordially yours,
Chas. W. Fay,
Postmaster.

Schedule for the Dispatch of Mail by Aeroplane Across Continent

From New York: Mail for Cleveland and all States west of Pa. deposited too late to be dispatched on through train No. 35, due to leave New York at 8:40 p. m.

At Cleveland, dispatch pouch for Cleveland City (delivery advanced one business day) and pouch of Ohio and Indiana to train 35 departing 12:47 p. m. (advancing 12 hours); take on mail for Chicago and Western States from Cleveland post office.

At Chicago, dispatch transit mails to trains departing between 5:30 and 9:15 p. m., overtaking through train No. 35 that left New York 8:40 p. m. and advancing Pacific Coast mail 24 hours; other Western States from 12 to 18 hours; leaving Chicago take mail for Omaha and west deposited too late for dispatch 9:15 p. m. previous day.

At Omaha, put off pouches for that city (delivery advanced one business day) take on mail for North Platte and all states west of Nebraska.

At North Platte, put off mail for North Platte (delivery advanced half day) and take on mail from that office for Western States; one pouch off and one on, balance mail through.

At Cheyenne, dispatch mail for Western States to train 9, due 10:40 p. m., advancing that taken on at Omaha and North Platte from 12 to 24 hours; have train 9 put off letter mail for Salt Lake City for dispatch via plane following morning.

At Salt Lake City; put off pouches for that post office and take on same weight mail for Reno and San Francisco, and connections at those offices, held off train 9 due to leave at 12:55 p. m.

At Reno: Dispatch mail for San Francisco and California to train 5, leaving Reno at 7:10 p. m. and arriving San Francisco at 7:30 a. m.; train 9 is due at Reno at 2:52 a. m., arriving San Francisco at 12:30 p. m.; take San Francisco letter mail off this train and fly it to San Francisco arriving at 8:30 a. m., advancing delivery half day.

From San Francisco, take mail for east received after departure of train 10 at 9:00 p. m.; also pouches for Reno and Salt Lake City.

At Reno, put off one pouch for that office and take on one pouch containing mail for eastern states; also pouch for Salt Lake City.

At Salt Lake City; dispatch eastern mail to train 20 at 6:50 p. m.; this train left San Francisco at 1:00 p. m. previous day and all mail advanced 24 hours. From Salt Lake; take mail for the East from Los Angeles-Salt Lake train and night accumulation at Salt Lake, advancing this mail about 12 hours.

At Cheyenne; put off mail from Salt Lake for train 6, thus advancing this mail 12 hours, and take from train 6 600 pounds through Eastern mail and 400 pounds Omaha mail, which will be delivered at Chicago that afternoon, thus advancing this mail for New York City and the New England States one full day.

At Omaha; put off mail for Omaha post office and take on same weight of mail for Chicago and eastern states.

At Chicago; dispatch mail for Chicago post office and all transit for eastern points, connecting early evening trains and advancing delivery of all one business day; if carried by rail from North Platte and Omaha would not arrive Chicago until 7:00 a. m. next day. Leaving Chicago take mail for New York City and New England States also pouch for Cleveland.

At Cleveland; put off pouch for Cleveland and take on same weight of mail for New York City and New England States.

At New York; mail received at Chicago and Cleveland advanced 17 hours; connection made at New York for Boston which advances delivery of practically all New England one business day; train connection from west is via Albany.

There is only one through train connection in 24 hours between New York and San Francisco. This is train 35, leaving New York at 8:40 p. m. The bulk of New York's tremendous mail is deposited in letter boxes in various parts of the city after 4 p. m. It is clear this mail—amounting to car-loads—cannot be collected, delivered into the post office and distributed in time to get all of the San Francisco and Pacific Coast mail on the 8:40 train. There is no through train service until the next night at 8:40 o'clock.

The aeroplane takes 400 pounds, or 16,000 of these left-over letters and delivers them to train No. 35's connection at Chicago Tuesday afternoon. This mail has thus been advanced 24 hours.

The Air Mail at Chicago then awaits the arrival at Chicago of train No. 43, from which it takes 1,000 pounds of San Francisco and Pacific Coast mail and carries it to Cheyenne where it overtakes train No. 35's connection and delivers the mail to that train. These 1,000 pounds of mail have been thus advanced 24 hours.

At Cheyenne, the Air Mail takes from the train the 16,000 letters originally carried by plane from New York to Chicago and delivers them that same afternoon in San Francisco. The train would not have arrived in San Francisco until the next afternoon.

By this service the Air Mail will advance daily 400 pounds of mail 42 hours and 1,000 pounds 24 hours into San Francisco. The 42 hours' saving cuts the train time between New York and San Francisco nearly in half.

Leaving San Francisco at daybreak for New York, you advance the mail 24 hours by putting it on train 20, leaving Ogden at 6:25 o'clock that afternoon. Leaving Salt Lake at 6 o'clock in the morning, you advance the mail from the Salt Lake and Los Angeles line, and local night accumulations in Salt Lake, 12 hours into Cheyenne. At Cheyenne, take the mail from train 6 for New York and advance that into Chicago 24 hours. Leaving Chicago at 6 a. m., you advance the mail to the patrons in the New England and Atlantic States one full business day.

With the establishment of the transcontinental Air Mail there will be at the service of the United States military forces what is probably the greatest system of regularly maintained landing fields and facilities in the world, a system that will enable the movement of air fleets from ocean to ocean, with large landing fields and fueling and repair facilities approximately every 200 miles. There will be the 14 Air Mail landing fields with the longest single jump 248 miles, as follows:

Field	*Distance*	*Hangars*
Hazelhurst, Long Island......		3— 60x100
Bellefonte, Penna	230 Miles	1— 60x100
Clarion, Penna	100 “	1— 60x60
Cleveland, Ohio	100 “	1—100x100
Bryan, Ohio	165 “	1— 80x100
Chicago, Ill.	155 “	3— 90x100
Iowa City, Iowa..............	191 “	1— 60x100
Omaha, Nebr.	233 “	1—125x125
North Platte, Nebr...........	248 “	1— 80x90
Cheyenne, Nebr.	205 “	1— 80x90
Rock Springs, Wyo...........	237 “	1— 80x90
Salt Lake, Utah..............	163 “	1— 80x100
Elko, Nevada	235 “	1— 60x100
Reno, Nevada	200 “	1— 80x90
Sacramento, Calif.	97 “	(Army Field)
San Francisco, Calif.........	92 “	1— 80x90

Good emergency landing fields will be found between each of these regular stops. Practically all of the cities and villages 5 miles north and 5 miles south of the transcontinental Air Mail line have agreed to paint in 4-foot letters the names of the cities on the roofs of one or more prominent buildings for the guidance of all pilots.

The Trans-continental daily Air Mail is the most difficult flying project yet undertaken. Not only has it required the working out of infinite details for a daily operation of a route nearly 3,000 miles long, but the actual flying will be under most trying conditions. At Cheyenne, Salt Lake and Reno the daily flying with a full load of mail has to be at altitudes ranging from 12,000 to 14,000 feet above the sea level, and over occasional highwind-swept plateaus with powerful head winds to cut down the speed of the planes. Intense cold weather will be encountered, as well as snow and against these contingencies all advance preparations possible have been made. Powerful radio stations for communication with the planes in the mountain sections have been installed at Reno, Salt Lake, Cheyenne and Omaha, and every precaution is being taken for the safety and comfort of the pilots in the difficult mountain flying during the coming winter.

The flying difficulties encountered on this route as a daily undertaking have not been under-estimated by the Post Office Department. Through the co-operation of the Weather Bureau, the Air Mail officials have been able to plot the average daily weather conditions for a twenty-year period, and the Department has been able to so lay out its flying schedule that the planes in the main will be able to pass over the windswept sections at the hours of least wind interference. The greatest difficulty in this respect will be encountered by the westbound planes between Cheyenne and Laramie. Last

(*Continued on page* 89)

THE NEWS OF THE WEEK

Aviator Rescues Four Marooned On Island

Mount Clemens, Mich.—Marooned on Strawberry Island, off the western shore of Lake St. Clair, for twenty-four hours, Mr. and Mrs. George Dalby of Mount Clemens and Mr. and Mrs. Morris Charbeneau of Detroit were rescued recently by Lieut. Machle of Selfridge Field with a fast sea sled.

When the Dalbys failed to return in the morning the commandant at Selfridge Field sent out Lieut. Machle in an army observation aeroplane. After flying along the mainland for thirty minutes Machle noticed the marooned party on the island. He returned to the camp and set out immediately in a fast motor boat and sled to the rescue.

Plan to Place Elgin, Ill., on Aerial Map

Elgin will be one of the principal cities on the central aerial map of the United States, if the plans of Captain Horace B. Wild, aeronautical engineer for the Nebraska Aircraft corporation, Mayor Arwin E. Price, and Association of Commerce officials, materialize.

A tentative plan for securing an aviation landing field, possibly the Hoornbeek field, to be improved and leveled for landing purposes, equipped with a hangar, was broached to Mayor Arwin E. Price, and to members and officials of the Association of Commerce of Elgin.

Captain Wild arrived there from Omaha, Nebr., via aeroplane, touring this section of the country in the interest of locating landing fields for an aeroplane route from coast to coast, and for the general promotion of aviation, both as a business and a pleasure. The coast to coast aeroplane the captain said, was intended primarily for passenger and freight business.

Leaps Into Water From Aeroplane

C. D. Mathews, a former army aviator, of Oklahoma, jumped from the right wing of a seaplane at Ocean View, Va., recently while Pilot Adams was flying the plane at an altitude of 40 feet. Aviator Mathews landed in the water without accident.

Passenger Plane Go 625 Miles Without Stop

Paris.—The longest aerial passenger line in the world has just been inaugurated between Toulouse, France, and Rabat, Morocco.

The distance is approximately a thousand kilometers, or twelve hours of flight over the Mediterranean without a landing. The price of a berth—for sleeping facilities are provided—is 1,560 francs or about $300.

The company inaugurating the line claims to have organized flights over more than 330,000 kilometers during ten months without a single accident or hurt to a passenger.

Keeps Appointment By Air

Col. R. G. Cholmeley-Jones, director of the war risk bureau, was scheduled to speak in the afternoon recently at the convention of the New Jersey American Legion at Atlantic City. On that morning he was unavoidably delayed in New York, and telephoned this fact to Maj. Grover F. Sexton, chief of the field force.

Consulting a railway time table, Maj. Sexton found he could not arrive in Atlantic City in time to deliver a speech in place of Col. Cholmeley-Jones. Rather than disappoint the legionnaires, he obtained permission from the Army Air Service to use one of the army planes to carry him to the famous resort.

At 10:30 o'clock, the plane, carrying the pilot, Maj. Sexton and his aide, Capt. E. S. Bettelheim, left for Atlantic City.

Polo Game Umpired From Aeroplane

A new use was recently found by the officers of the First Bombardment Group, Kelly Field, for the radio telephone.

The polo team from Camp Travis was engaged in a hot contest with the Kelly Field team when there appeared in the sky a DH-4-B piloted by Lieut. Speck with Lieut. Doyle as observer. After circling around a few minutes he radiophoned to the ground station. "Is Camp Travis team wearing purple?" The answer was "Yes." With this information the observer was able to follow the game closely at an altitude of 7,500 feet. He reported the entire game and often would call team play errors such as "bashing," "failure to cover your man," etc. It was plainly evident to all that the umpire from the plane was absolutely accurate and plays and errors were detected which had apparently gone by unnoticed by the ground watchers.

It is believed that this is the first time in the sporting world that a polo game has been reported from an aeroplane by radio.

Uses Aeroplane to Visit Mother

In order to spend a few hours with his mother at her summer home at Glen Cove, L. I., Edward Morris, head of the Morris Packing Company of Chicago, made an aeroplane flight recently from Atlantic City, where he was attending the meat packers' convention. Morris landed in Mineola and finished the trip by automobile. He flew to Philadelphia the next day to keep a business appointment.

Nashville, Tennessee, photographed from the air by the Nashville aviators

Predict Cannon-Carrying Aeroplanes and Amphibious Tanks

Washington.—Amphibious tanks such as predicted by Gen. Estinne of the French Army, in press despatches from Paris, as part of the mechanical elements replacing man power in future wars. are not considered visionary by American Army officers who have studied closely the lessons taught by the World War.

These officers declared today that not only these tanks but cannon carrying aeroplanes, armored cars with the speed of express trains and huge steel defying heavy gun-carrying land battleships are in the realms of immediate possibility.

Proof of the concreteness of the prediction of amphibious tanks is given in a recent successful tryout of a tank invented by an Englishman which repeatedly crossed a river in the south of England. While the depth of the river is not stated, the little information that seeped through the censorship on war inventions still in force in England asserts that the tank crawled through water deeper than its height.

Information gathered recently by American Army observers in France and in England, and now in the hands of the General Staff, shows that both countries are constantly trying out inventions and developing ideas formed as the result of tank wars in France.

England has retained her full corps and has concentrated it in huge camps where the machines that proved so successful in the drives against the Germans are being perfected and new tanks are being built.

Promoted to Major

Capt. Walter W. Vautsmeier, Commander of B Squadron, at March Field, Riverside, Cal., regular army man, and a graduate of West Point with the class of 1910, has been promoted to the permanent grade of major.

Major Vausmeier reported at March Field for duty recently from the coast artillery base at Fort McArthur. He was formerly in the Air Service having qualified at Kelly Field and in France during the war.

Says Aerial Mail Is Run for Speed, Not Profit

San Francisco.—Colonel John A. Jordan, chief construction officer of the Aerial Mail Service, recently stated that the Post Office Department is not run as a profitable institution. If it were, over 80 per cent of its normal operations would cease and would be continued only in large cities. We do not wish to make the Post Office Department pay, nor could it do so if it tried. Our Post Office Aerial Mail Service, particularly since it came into the hands of Mr. Burleson, is being run with the greatest amount of speed. We are trying to do our best for speed of mail delivery for common people as well as big business interests.

In all matters except the transportation of mail the Post Office Department is strong for economy.

There is another phase of aerial mail about which people seem to know very little. The department is now drilling a large force of pilots and ground men who, in case of an emergency, can be placed at the disposal of the army or navy within forty-eight hours' notice. No nation in the world has such a scheme.

Aerial Forest Patrol to be Extended

Arrangements to extend the aerial forest patrol until it covers the entire Northwest are being made by Major H. H. Arnold, in charge of the San Francisco office of the Air Service.

The War Department at Washington has granted authorization to organize reserve Aero squadrons for this purpose, the squadrons to be composed of reserve officers and enlisted men who will be on active status from May 15 to October 15. The officers will serve as pilots or observers.

Major Arnold is making an attempt to recruit reserve officers from the members of the aviation clubs of the Bay Cities. He addressed the Pacific Aero Club at a luncheon recently, explaining the proposal.

Reserve officers while on this special duty will receive pay according to their grade and in addition 50 per cent increase for going in regular and frequent flights. A tentative proposal has been made to the War Department which provides for reserve squadrons being stationed at Los Angeles, San Francisco, Portland, Seattle and Spokane.

Aerial Forest Patrols Save Forests

Army aeroplanes operating from six bases in California and Oregon located 494 forest fires in a period of less than two months and a half, according to reports. In California fifty-three of the fires were reported by wireless from aeroplanes assigned by the Army Air Service to cooperate with the Forestry Service in protecting the national forests.

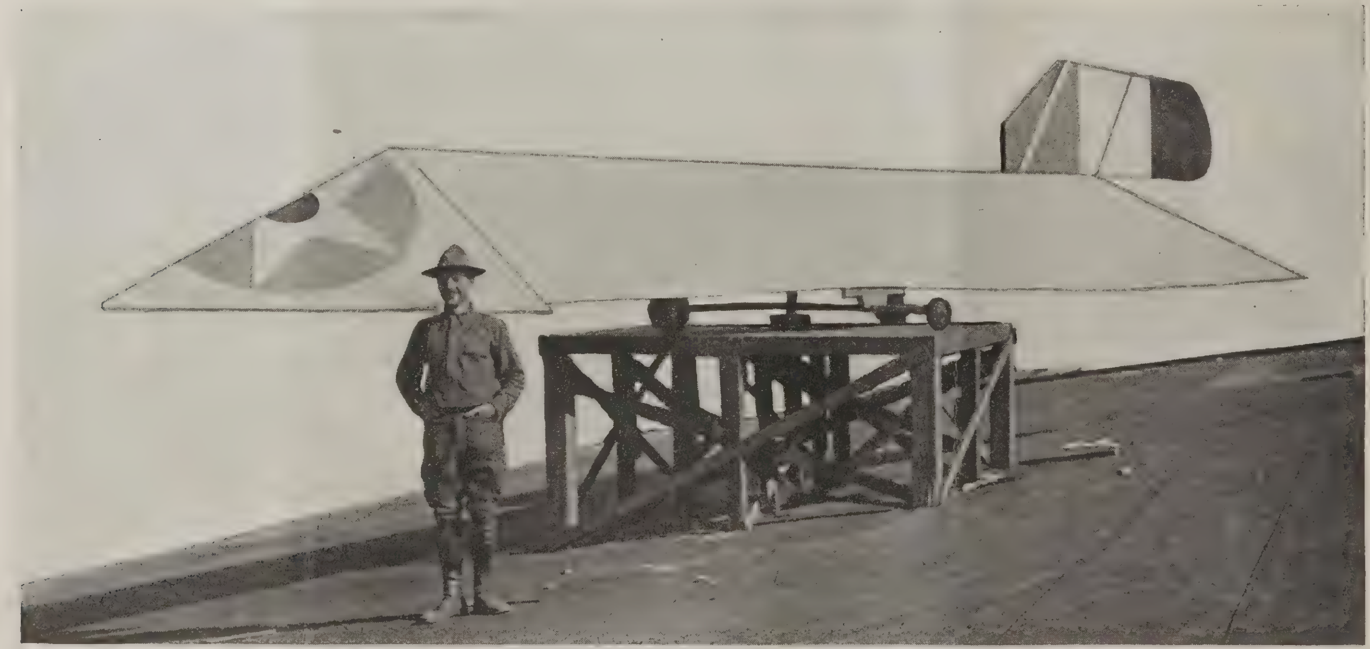
According to the reports enough valuable property was saved by means of the planes to equal the total appropriation made during the year for the entire Army Air Service.

Badgers Would Aid Reserve Plan

Chicago's new aerial reserve project has the hearty support of Milwaukee airmen. A flying unit to form the nucleus of an American air service will be organized at a meeting of former aviators at Chicago. Wealthy Chicagoans are promoting the movement, which is not connected with the army.

F. H. Vaughn, president of the Aero club of Wisconsin, has invited the flyers to come and use the Milwaukee airport at any time. If the project is carried through the Wisconsin club will do all they can to co-operate with the new unit.

Neither the military nor congress is to be called on for aid. Those behind the movement, it is said, have purchased eighteen of the latest types of aeroplanes and a large landing field, and have ordered the construction of a hangar. It is understood the flyers will be offered facilities for constant practice with latest types of planes without cost. The organizers also intend to establish a school for teaching the automotive part of aeroplane science.



The wind vane invented by Captain Lawrence C. Cook, U. S. Air Service. Patents applied for

The AIRCRAFT TRADE REVIEW

Decision in Wright vs. Aerial Transport Corporation Action

The District Court has rendered the following decision in the Wright vs. the Aerial Transport Corporation:

In the District Court of the United States
for the District of Delaware
Wright Aeronautical Corporation,
Plaintiff, v.
Aerial Transport Corporation,
Defendant.
No. 393 in Equity

Wright Aeronautical Corporation by its bill of complaint alleges and by supporting affidavits offers evidence to show its ownership of U. S. Letters Patent No. 821,393, issued May 22, 1906, to Orville Wright and Wilbur Wright for new and useful improvements in flying machines; that the patent has been adjudicated and held valid in several strongly contested cases; that infringement thereof is threatened by the defendant, Aerial Transport Corporation, and that such infringement unless prevented by judicial action will result in irreparable injury to the plaintiff; and prays for a preliminary injunction restraining and enjoining the threatened injury. The affidavits filed by the defendant do not question the validity of the patent, do not challenge plaintiff's title thereto, and do not deny that the foreign-made machines which plaintiff asserts the defendant threatens to use come within the claims, or some of them, of the Wright patent; but such affidavits do undertake to show an absence of a threat on the part of the defendant to infringe as alleged. Whether a preliminary injunction should be granted or denied hinges upon the existence or non-existence of such threat. The defendant admits that at some time heretofore it planned to acquire and use in the United States the foreign-made machines, but also shows tha prior to the filing of the bill of complaint herein its efforts looking to that end had ceased. The affidavits of the defendants further say: "The defendant has no airplanes and never had any. Defendant has no contract or option or understanding for any airplanes; . . ." This showing is not disproved by the plaintiff. The defense might have had the appearance of being more candid and more complete had there been an express denial of the existence of any intention on the part of the defendant to use the airplanes in question. I shall, however, now assume that such is the meaning the defendant's affidavits were intended to convey. It follows that the evidence taken as a whole establishes no reasonable probability of injury to the plaintiff, and that the motion for a preliminary injunction should be denied but the denial will be without prejudice to the right of the plaintiff to renew its motion should the defendant use or take any action looking to the use of the airplanes alleged to infringe the Wright patent.

A decree may be prepared and submitted.
(Sgd.) HUGH M. MORRIS.
September 11, 1920. J.
A TRUE COPY.
ATTEST: (Seal of United States District Court in Delaware).
WM. G. MAHAFFY, Clerk.
By (Sgd.) H. C. MAHAFFY, Jr., Deputy.

Evansville Soon to Have a Large Aeroplane Factory

The Hurst Aeroplane Company will soon begin erecting their new aeroplane factory on their aviation field in Evansville. Mr. U. R. Hatfield, who has the contract for selling the stock in the company, has had several men out selling stock for several weeks past, and it is only a question of a few days now before sufficient money will be in hand to begin the building and putting of the machinery in motion.

The people at the head of the Hurst Aeroplane Company have spent considerable time and money perfecting their new design aeroplane, and it is now conceded by the best aeroplane experts of the country that the Hurst plane is one among the best planes on the market, and it is their intentions to turn out several planes per week during the first year's operation.

The business men of Evansville should be proud of this large enterprise being located there, as it will no doubt mean a lot of business throughout the entire city, and will employ large forces of men; besides furnish aeroplanes for immediate use in and near their city.

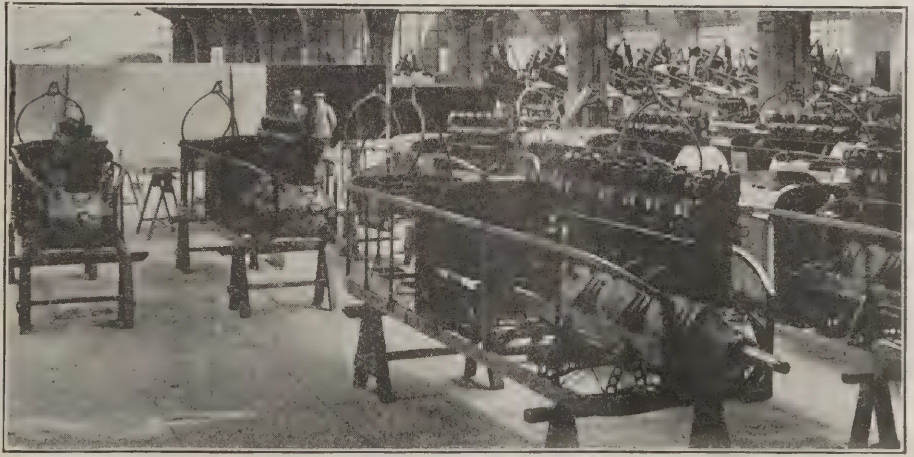
The aeroplane industry has one of the most promising futures of any branch of business in this country since the automobile industry made its appearance several years ago, and those who have invested in the Hurst Aeroplane Company should be glad to be financially connected in the beginning of such a wonderful enterprise that has the broadest and almost unlimited possibilities before it that the aeroplane business now has.

It is now most generally known that there are numbers of aeroplane transportation companies being organized and promoted throughout the country for the purpose of using aeroplanes for transportation of passengers and freight; also, it is understood that there will be a number of through mail routes by aeroplane put in use before very long; besides, a number of aeroplanes are now being sought by private owners, and it can't be but a short time before the people owning and controlling the Hurst Aeroplane Company can see the real need of their undertaking which they have recently started.

Wright Aeronautical Corporation Sues On Its Patents

The Wright Aeronautical Corporation brought suit against Handley-Page, Ltd., the Aircraft Disposal Company, Ltd., and William H. Workman in the United States District Court in September, for alleged infringement upon patent rights. Injunctions and an accounting of profits are asked.

The action is based on the Wright patents issued in 1906 which were transferred to the Wright Aeronautical Corporation last October. The complaint alleges that the defendants, without license, manufactured, used or sold aeroplanes embodying the inventions of the Wright Brothers, the validity of patents upon which was established in prior litigation.



Engine assembly in Italian aeroplane factory

Albert S. Burleson, Postmaster General
Otto Praeger, Second Assistant Postmaster General
Leon B. Lent, General Superintendent, Air Mail Service

J. Clark Edgerton, Chief of Radio
Charles I. Stanton, Chief of Maintenance
George L. Conner, Chief Clerk

D. V. Colyer, Chief of Flying

PILOTS

H. H. Rowe
J. P. Murray
C. V. Pickup
C. A. Braukman
S. S. Boggs
F. R. Yager
J. P. Woodward
B. M. Hefron
J. L. Mortensen
G. C. Black
Eric Springer
W. H. Jones
Ralph Watson
J. W. Sharpnack
J. L. Eaton
E. E. Mouton
W. L. Morgan
W. H. Williams
R. S. Little
K. M. Stewart
W. R. Holcomb
W. M. Barr
E. R. Vanatta
W. D. Williams
H. A. Chandler

P. W. Smith, Superintendent, New York-Chicago Division
E. W. Majors, Superintendent, Chicago-Omaha Division
A. R. Dunphy, Superintendent, Omaha-Salt Lake Division
John A. Jordan, Superintendent, Salt Lake-San Francisco Division
Carl Egge, Superintendent, Twin City-St. Louis Division
J. E. Whitbeck, Superintendent, New York-Washington Division
R. F. Holderman, Manager, Hazelhurst Field, L. I.
M. J. Kelly, Manager, Bellefonte, Pa.
H. M. Guerney, Manager, Cleveland, Ohio
S. M. Moore, Jr., Manager, Chicago, Ill.
H. S. Long, Manager, Iowa City, Iowa
H. L. Hartung, Manager, Cheyenne, Wyo.
W. I. Votaw, Manager, Omaha, Nebr.
G. R. Houston, Manager, Salt Lake City
O. A. Tomlinson, Manager, Reno, Nev.
Vern Hinkley, Manager, San Francisco
W. G. Witzel, Manager, St. Louis, Mo.
F. A. O'Leary, Manager, Washington, D. C.
C. A. Parker, Superintendent of Repairs, Bustleton, Pa.
E. W. Majors, Superintendent of Repairs, Chicago, Ill.

PILOTS

E. M. Allison
E. C. Davis
E. M. Haight
W. L. Carroll
Rufus Riddlesbarger
A. L. Jewett
L. H. Garrison
R. A. Reed
H. C. Brown
R. G. Jones
E. F. Baskey
Bryan McMullen
H. W. Cook
L. S. Amberg
E. Hamilton Lee
Robert H. Ellis
Randolph G. Page
Elmer G. Leonhardt
Frederick A. Robinson
Walter J. Smith
Wesley L. Smith
James T. Christensen
Harry Huking
Clarence C. Lange
William C. Hopson

Awards Made for Three Aerial Mail Routes

Washington.—Contracts for three new aerial mail routes at a total cost of $685,000 a year have been awarded by the Post Office Department to the Lawson Air Line Company of Chicago.

The contracts call for aeroplane mail service from Pittsburg to St. Louis by way of Columbus, Cincinnati and Indianapolis, at a cost of $147,000 a year; between New York and Chicago, via Harrisburg, Pittsburg and Fort Wayne, Ind., $238,000 a year, and for service between New York and Atlanta, via Washington, Raleigh, N. C., and Columbia, S. C., at a cost of $300,000.

Passengers as well as mail will be carried on three aerial mail routes, contracts for which were awarded to-day to the Lawson Air Line Company of Chicago by the Post Office Department.

The first service will start between Pittsburg and Indianapolis, via Columbus and Cincinnati in November.

Palatial aerial liners, with wicker chairs, enclosed in glass windows, and with stream line bodies, are being built for the new service, officials of the company announced.

The Government contract provides that each plane must carry 1,500 pounds of mail per trip. In addition the company is providing accommodations for sixteen passengers, the latter end of the business being a private venture. Three hundred and six round trips are to be made yearly on each route.

Service on the New York-Chicago and New York-Atlanta routes probably will not be inaugurated until next spring. Connecting air lines between Cleveland and Detroit and Chicago and Indianapolis probably will be opened later, the company announced.

A night service on the lines will be started, and standard berths will be part of the equipment, Floyd K. Smith, assistant general manager of the company, said. Shower baths and all modern conveniences will be installed.

Half hour stops will be made at each of the controls, and the company will open restaurants on the landing fields for the service of the passengers.

John A. Jordan, superintendent of the Salt Lake-San Francisco division of the Transcontinental air mail route

UNITED STATES POST OFFICE DEPARTMENT

CHICAGO-OMAHA ROUTE—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, May, 1920

													SERVICE AND UNIT COST						
Aeroplane No.	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	Gallon of Gasoline	Total Time Run		Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
														hr.	min.				
70	....	....	$78.34	$32.83	$10.63	$143.18	....	$73.32	....	$25.00*	$94.04	$457.34	......	...	...	......	......	......	....
76	$159.84	$30.08	78.35	32.83	10.64	143.18	$347.73	90.24	$63.90	50.00	94.04	1,100.83	592	31	28	2,870	4.8	$34.98	$0.38
79	29.16	3.51	78.35	32.83	10.64	143.18	29.81	8.58	9.49	50.00	94.05	489.60	106	2	42	220	2.0	181.33	2.23
94	234.60	37.97	78.35	32.83	10.64	143.18	527.90	111.41	34.20	50.00	94.05	1,355.13	860	47	49	4,400	5.1	28.34	.31
104	107.09	19.44	78.35	32.83	10.64	143.19	309.86	82.44	101.50	32.00*	94.05	1,011.39	397	28	04	2,640	6.6	36.03	.38
106	....	....	78.35	32.84	10.64	143.19	....	49.35	....	25.00*	94.05	433.42	......	...	...	......	......	......	....
Total	$530.69	$91.00	$470.09	$196.99	$63.83	$859.10	$1,215.30	$415.34	$209.09	$232.00	$564.28	$4,847.71	1,957	110	03	10,130	5.1	$44.05	$0.48

Cost per mile, overhead, $0.15; cost per mile, flying, $0.18; cost per mile, maintenance, $0.15.
All planes shown on this report are De Havilands, equipped with Liberty 12 motors.

*Indicates that plane appears on another report.

OTTO PRAEGER, Second Assistant Postmaster General.

LOCATION OF INTERPLANE STRUTS

By A. S. Niles and B. C. Boulton, Aeronautical Engineers,
Engineering Division, Air Service

THE object of this investigation was to find by trial the most economical location for the struts of different types of aeroplanes, and to learn the effect of different variables in changing this location.

The types of aeroplanes investigated were the monoplane, the single-bay, and the two-bay biplane, and the three-bay biplane. The effects of changing the aspect ratio, the gap-chord ratio, and stagger, and of making the spars continuous were considered.

As a result of this study the proportions in Table 1 are recommended for the different types of aeroplanes.

The most important deductions from the computations of this investigation are as follows:

1. When the spars are continuous at the center, the bays tend to increase in proportion to the total length, and the cantilever to decrease. This effect of the continuity of the spars is the most important factor in determining the location of the strut points in any given type of aeroplane.
2. A decrease in slope of the lift wires or monoplane struts will increase the proportionate length of the cantilevers. It is through this change of slope that a change in the aspect ratio or the gap-chord ratio affects the economic location of the strut points. In any case within the limits of practical designing the effect is not great, and where the spars are continuous over the center and there is no center span it is negligible.
3. Where the spars are continuous over the second joint from the left, the economical location of the struts is that which will make the factors of safety at this joint and the first joint from the left equal. If this second joint is not at the center line of the machine, the proportion of the bay to the right of it and the bay to the left of it may be changed considerably without appreciably changing the strength of this joint. The proportions may be chosen so that the bay to the right or the bay to the left of this joint will be of the same strength as the joint, or both bays may be made stronger.
4. Staggering the wings of a biplane does not materially if at all, change the economical location of the strut points.
5. Owing to the absence of direct compression in the spars of the lower wing, it is the upper wing which governs the design. A change in the design of the lower wing will cause a change in the stress in the outer strut. This will affect the direct compressive stress in the bay 1—2 in the same manner as a change in the slope of the lift wires. The effect on the economical location of the strut is negligible for any likely difference in design of the two wings.
6. If the rear spar be made longer than the front spar, the factor of safety at joint 1 of the rear spar will be decreased, and at joint 2 and in the bay 1-2 will be increased. The probability of using this type of construction was considered to some extent in recommending proportions. It is suggested that if the rear spar is made the longer, that the bays be proportioned in the basis of a mean spar with a length equal to that of the front spar plus one-third of the difference in the lengths of the two spars.
7. The physical properties of the spar section have an influence in the economical location of the struts. The effect is small with small aspect ratios, but becomes appreciable with large aspect ratios such as are found in three bay biplanes.

TABLE 1
Recommended Proportions

	Cantilever	Bay 1-2	One-half Bay 2-3	
Monoplane:				
Without center span.				
Hinged at center.				
Aspect Ratio 4.0	34½	65½	0	
Aspect Ratio 5.0	35½	64½	0	
Continuous at center				
Aspect Ratio 4.0 and 5.0	32½	67½	0	
With center span.				
Continuous throughout.				
Aspect Ratio 5.0	25	53½	21½	
Biplane—Single Bay:				
Without center span.				
Hinged at center.				
Aspect Ratio 4.0 and 6.0	36½	63½	0	
Continuous at center.				
Aspect Ratio 4.0 and 6.0	32½	67½	0	
With center span of 30 in.				
Hinged at Joint 2.				
Aspect Ratio 4.6	36	64	0	
Aspect Ratio 6.6	37	63	0	
Continuous at Joint 2.				
Aspect Ratio 5.6	34	66	0	
With center span greater than 30 in.				
Continuous throughout.				
Aspect Ratio 4.0 and 5.3	25	51½	23½	
Lower wing only.				
Hinged at Joint 2.				
Aspect Ratio 6.6	32½	67½	0	
Biplane—Two Bay:			Entire Bay 2-3	Entire Bay 3-4
With center span of 30 in.				
Hinged at Joint 3.				
Aspect Ratio 7.0	24½	45½	30	
Biplane—Three Bay:				
With center span of 30 in.				
Hinged at Joint 4.				
Aspect Ratio 9.0	20	40	25	15

NOTE: The length of the cantilever in the above table is the actual cantilever length of the spars, not the loaded length used in sand test.

In all cases the following data were assumed:

R.A.F. 15 Wing Section.

50 in. chord.

Front spar 13 per cent of chord back from leading edge (see Fig. 1).

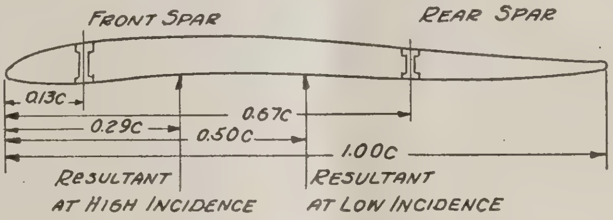
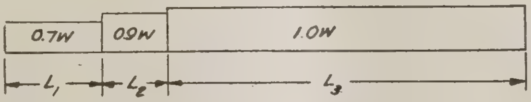


FIG. 1



L_1 = 0.5 CHORD
L_2 = 0.5 CHORD, OR DISTANCE TO STRUT POINT, WHICHEVER IS THE SMALLER.

FIG. 2

Rear spar 67 per cent. of chord back from leading edge.

Net wing loading 7.5 lbs. per sq. ft.

Location of center of pressure for high incidence condition at 29 per cent of chord.

Location of center of pressure for low incidence condition at 50 per cent. of chord.

Square wing tips.

Decrease in tip loading as indicated in Fig. 2.

Spar Properties

	Front	Rear
Area	2.15	2.08
I	1.94	1.12
I/y	1.34	0.99
ρ	0.95	0.735

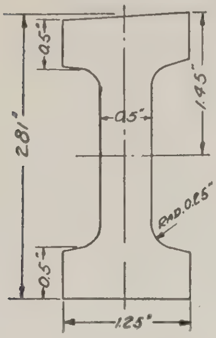
Sections of these spars are shown in Figs. 3 and 4.

As the same spars were used in all cases, the factors of safety obtained may be used to compare the relative strengths of differing types of construction as well as the relative strengths of different parts of the same design.

The most economical location of the struts for any given set of conditions was found by trial. The moments and shears in the spars were calculated, when necessary, by use of the Three Moment Equation. In some cases, however, they were statically determinate. The direct compression, and the stresses due to drift and stagger were computed by considering the trusses pin-connected.

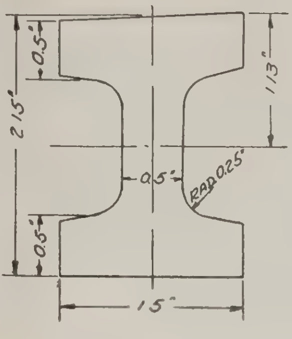
The moments, etc., were computed for the wing as a whole. The front spar was figured on the basis of 0.704 of this total load and the rear spar on the basis of 0.685.

The factors of safety for each spar were computed at the different joints and at the points of zero shear between the joints. It was first hoped to obtain such proportions for the



FRONT SPAR

FIG 3



REAR SPAR

FIG 4

bays that all of these critical points should be of equal strength. This was found to be impractical in most cases, as only as many factors can be equated as there are bays subject to change. Thus in the monoplane without a center span (see Fig. 5) there are two variable lengths, the cantilever and bay 1-2; the factors of safety at 1 and 2 can be equated but not the factors at 1, 2, and the point of zero shear in bay 1-2. If, however, a variable center span (bay 2-3) is added, any three of the four factors of safety can be made equal, but not all four.

The ultimate allowable stresses were computed by the formula:

$$f_a = \left[\frac{f_b}{f_b + f_c}(F - C)\right] + C$$

f_a = ultimate allowable stress.
f_b = calculated stress due to bending.
f_c = calculated stress due to compression.
F = modulus of rupture equals 8,200 lbs. per sq. in.
C = maximum allowable P/A as determined by the formulae.

$$\frac{P}{A} = C - \frac{C^2}{4\pi^2 E}\left(\frac{L}{\rho}\right)^2 \text{ when } \frac{L}{\rho} \text{ is less than 74 and}$$

$$\frac{P}{A} = \frac{\pi^2 E}{\left(\frac{L}{\rho}\right)^2} \text{ when } \frac{L}{\rho} \text{ is greater than 74.}$$

When considering a point near the center of a bay, the length of the column was taken as equal to the length of the bay. At inner strut points where column action was present, the column length was taken as equal to 0.2 the span on one side of the strut plus 0.2 the span on the other side. At cantilever strut points C was taken as the full compressive strength of the material, 5,500 lbs. per sq. in.

The deflections of columns due to lateral loading were obtained by means of the formula:

$$EId = X(X - L)\left[\frac{M_1}{2} + \frac{S_1}{6}(X + L) + \frac{w}{24}(X^2 + XL + L^2)\right]$$

E = modulus of elasticity equals 1,600,000 lbs. per sq. in.
I = moment of inertia of the spar in in. ^{4}.
d = deflection of the spar in inches.
X = distance from point 1, at the outer end of the bay under consideration, to the point of zero shear.
L = length of the bay.
M_1 = bending moment at point 1. In this work always positive.
S_{+1} = shear at right of point 1. In this work always negative.
w = uniform load in lbs. per running inch.

The increase in the bending moment at the centers of the bays due to the lateral loading of the spars was found by multiplying this deflection by the direct compressive force. This moment varies as the square of the load factor, as it is the product of two quantities each of which varies directly as the load factor. $\frac{My}{I}$ will decrease, therefore, faster than the load factor and the computed factor of safety will be larger than it should be. This is corrected by multiplying the product of the deflection and the direct compression by the factor of safety, as the product of these three quantities varies directly as the load factor.

In this work the factors of safety at the different joints were figured first and the factor at the weakest joint was assumed to be the factor of safety at the points of zero shear when computing the value of M due to the lateral lead on a column. In order to obtain exact values for the factors of safety at the points of zero shear, it would be necessary to recompute this effect of the lateral loading until the value of the factor of safety assumed checked the value obtained from the entire calculation. This recomputation of the factor of safety was not done in this work as it was not necessary for the ends in view. The values of the factors of safety given for the bays 1-2 and 2-3, therefore, are not the exact values, though very nearly so.

In order to show the method of attack the complete computations for one trial are shown below

Computation of a Monoplane

Type: Without center span and with spars continuous. Dimensions assumed. (See Fig. 5.)

Cantilever = 33 in.
Bay 1-2 = 67 in.
h = 25 in.

To find running lead per in. (See Fig. 2.)

$$\frac{7.5 \times 50}{12 \times 12} = 2.61 \text{ lbs. per in. running.}$$

$$0.7 \times 50w + 0.9 \times 16w + 134w = 2.61 \times 200.$$

$$w = 2.85$$
$$0.9w = 2.56$$
$$0.7w = 2.00$$

$$M_1 = \frac{2 \times 33^2}{2} + \frac{0.56 \times 8^2}{2} = 1089 + 18 = 1107$$

$$M_1L_1 + 2M_2(L_1 + L_2) + M_3L_2 = \frac{w_1L_1^3}{4} + \frac{w_2L_2^3}{4}$$

$$1107 \times 67 + 2M_2(2 \times 67) + 1107 \times 67 = \frac{2.85}{4}(67^3 \times 2)$$

$$M_2 = 1045$$

$$S_{+1} = \frac{M_2 - M_1}{L_1} - \frac{w_1L_1}{2} = \frac{1045-1107}{67} - \frac{2.85 \times 67}{2} = -0.9 - 95.5 = -96.4 \text{ lb.}$$

$$S_{-1} = 33 \times 2 + 8 \times 0.56 = 66 + 4.48 = 70.5 \text{ lb.}$$

$$R_1 = 166.9 \text{ lb.}$$

$$X = \frac{96.4}{2.85} = 33.8 \text{ in.}$$

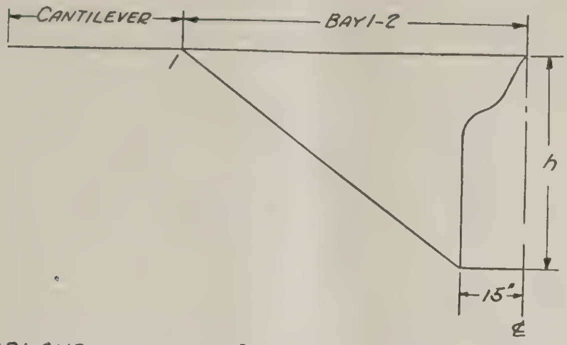
$$M_{1-2} = 1170 - 96.4 \times 33.8 + \frac{2.85 \times 33.8^2}{2} = -523.$$

$$C_{1-2} = 166.9 \times \frac{52}{25} = 347 \text{ lb.}$$

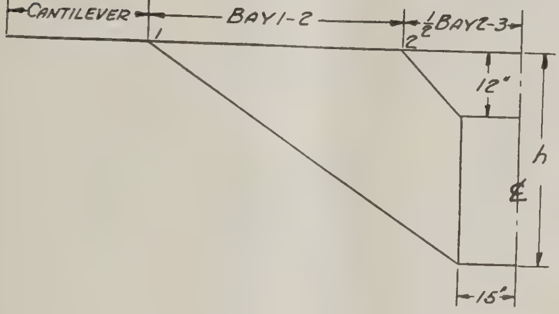
Tabulation of Loads

	Total	Front Spar =(0.704 Total)	Rear Spar =(0.685 Total)
M_1	1107	778	758
M_2	1045	736	717
M_{1-2}	523	368	358
S_{+1}	96.4	67.8	66.0
C	347	242	238
w	2.85	2.00	1.95

X = 33.8 in.
X — L = –33.2 in.
X + L = 100.8 in.



MONOPLANE WITHOUT CENTER SPAN
FIG. 5



MONOPLANE WITH CENTER SPAN
FIG 6

Computation of Factors of Safety

At point 1 front spar.

$$f_c = \frac{242}{2.15} = 112 \qquad f_a = \left[\frac{f_b}{f_b + f_c}(F - C)\right] + C$$

$$f_b = \frac{778}{1.34} = \begin{array}{r}580\\ \hline 692\end{array} \qquad = \frac{580}{692} \times 2700 + 5500 = 7760$$

Factor of safety

$$= \frac{7760}{692} = 11.2$$

At point 2 front spar.

$$\frac{0.2L}{\rho} = \frac{0.2 \times 2 \times 67}{0.95} = 28.2$$

$$f_c = \frac{242}{2.15} = 112 \qquad f_a = \frac{550}{662} \times (8200 - 5120) + 5120$$

$$f_b = \frac{736}{1.34} = \begin{array}{r}550\\ \hline 662\end{array} \qquad = 2560 + 5120 = 7680$$

$$\text{Factory of safety} = \frac{7680}{662} = 11.6$$

In span 1-2 front spar.

$$EId = -33.8 \times 33.2 \left[-\frac{778}{2} \times 100.8 + \frac{67.8}{6}(33.8^2 + \overset{2}{\underset{24}{33.8}} \times 67 + 67^2)\right]$$

$$d = \frac{33.8 \times 33.2 \times 92}{1{,}600{,}000 \times 1.94} = 0.0332 \text{ in.}$$

$$M_d = \overset{d}{0.0332} \times \overset{c}{242} \times \overset{F.S.}{11.2} = 90 \text{ in. lbs.}$$

Note: Factor of safety assumed is 11.2, that being the lower of the values of the factor at points 1 and 2.

$$f_e = \frac{242}{2.15} = 112 \qquad \frac{L}{\rho} = \frac{67}{0.95} = 70.5$$

$$f_b = \frac{368 + 90}{1.34} = \begin{array}{r}342\\ \hline 454\end{array} \qquad f_a = \frac{342}{454}(8200 - 3050) + 3050$$

$$= 3880 + 3050 = 6930$$

$$\text{Factor of safety} = \frac{6930}{454} = 15.3$$

To get complete accuracy, "M_d" should now be recalculated using a value of about 15.0 instead of 11.2 for the factor of safety. As it would be an unnecessary refinement, however, to do that in this work it has not been done.

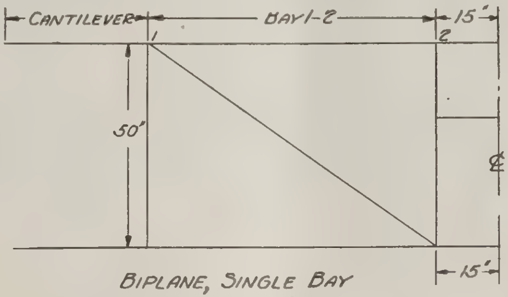
The factors of safety in the rear spar are calculated in the same manner.

Consideration of the Separate Types

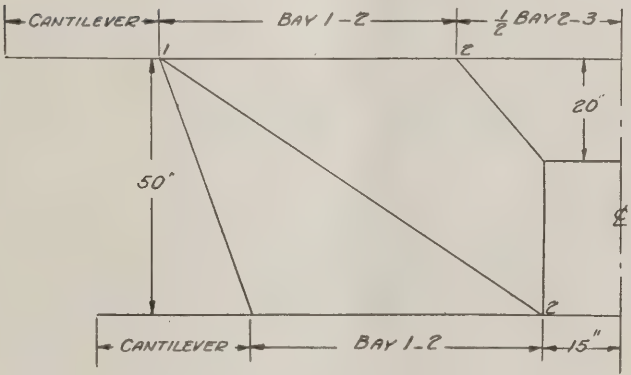
Monoplane.

Case I. Without center bay and hinged at 2. (See Fig. 5.)

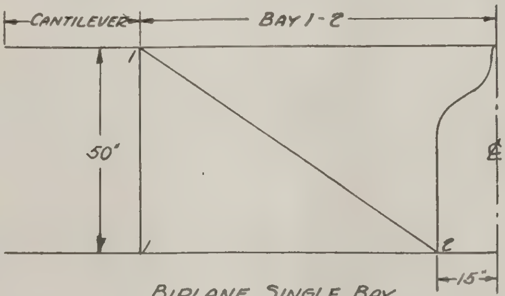
In computations for the monoplane the distance "h," see Figs. 3 and 4, was assumed as a certain proportion of the chord "c." In Cases I and II computations were made with



BIPLANE, SINGLE BAY
30 IN CENTER SPAN
FIG 7



BIPLANE, SINGLE BAY
CENT. SPAN GREATER THAN 30 IN.
CANTILEVER AND SPAN 1-2 SAME LENGTH IN BOTH WINGS
FIG. 8



BIPLANE, SINGLE BAY
WITHOUT CENTER SPAN
FIG. 9

two values of this ratio of "h" to "c," and in Case III for one value. The factors of safety computed for an aeroplane with an aspect ratio of 4.0 and a ratio of "h" to "c" of 0.55 are as follows:

	Trial 1		Trial 2		Trial 3	
	Cantilever 34%		Cantilever 35%		Cantilever 36%	
	Bay 1-2 66%		Bay 1-2 65%		Bay 1-2 64%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1...	10.6	8.47	10.1	8.07	9.68	7.66
Bay 1-2..	9.23	6.75	9.95	7.45	10.8	8.11

The best proportions are about 35 per cent cantilever and 65 per cent bay.

Two trials were made with the same aspect ratio but with the ratio of "h" to "c" increased to 0.85. The factors of safety for these trials are as follows:

	Trial 1		Trial 2	
	Cantilever 34%		Cantilever 35%	
	Bay 1-2 66%		Bay 1-2 65%	
	Front	Rear	Front	Rear
Joint 1	11.42	9.00	10.85	8.52
Bay 1-2	10.59	7.86	11.50	8.82

The best proportions would be about 34½ to 65½.

The change in the compression due to differences in slope of the struts affects the factor of safety in the bay 1-2 more than at the joints 1 and 2, and therefore any increase in this compression decreases the economical length of the bay 1-2 in proportion to the length of the whole wing.

If the ratio of "h" to "c" were kept constant and the aspect ratio were varied, the slope of the strut would be affeced and the economical location of the strut point would be changed in same manner. The results below were obtained for a monoplane with an aspect ratio of 5.0 at center hinge, and the ratio of "h" to "c" as shown:

	Trial 1		Trial 2		Trial 3	
	Ratio $\frac{h}{c}$ = 0.5		Ratio $\frac{h}{c}$ = 0.5		Ratio $\frac{h}{c}$ = 1.0	
	Cantilever 35.2%		Cantilever 36%		Cantilever 35.2%	
	Bay 1-2 64.8%		Bay 1-2 64%		Bay 1-2 64.8%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1...	6.13	4.92	5.92	4.72	6.85	5.36
Bay 1-2...	5.58	4.20	6.00	4.49	7.29	5.51

	Trial 4		Trial 5	
	Ratio $\frac{h}{c}$ = 1.0		Ratio $\frac{h}{c}$ = 1.0	
	Cantilever 34.4%		Cantilever 36%	
	Bay 1-2 65.6%		Bay 1-2 64%	
	Front	Rear	Front	Rear
Joint 1....	7.15	5.59	6.56	5.13
Bay 1-2 ...	6.80	5.04	7.84	5.92

The proportions recommended are 35½ per cent cantilever and 64½ bay 1-2.

As it is to be expected, the case with the high aspect ratio and low ratio of "h" to "c" has the shortest bay and longest cantilever since the strut has the least slope. It is evident that from the point of view of economy in the spare it is desirable to have the slope of the struts as great as possible.

Case II. Without center bay and with spar continuous at joint 2. (See Fig. 5).

This case was computed for an aspect ratio of 4, and ratios of "h" to "c" of 0.5 and 1.0. There are three factors of safety to be considered in this case, but only two spans of variable length; therefore, only two factors can be equated. If the factor for the bay 1-2 be equated to the factor for either of the joints the factor of safety at the other joint will be less than the two that are equal. If the joints be made of equal strength, however, the bay 1-2 will be stronger. Factors of safety obtained from the different trials are as follows.

	Trial 1		Trial 2		Trial 3	
	Aspect Ratio 4.0		Aspect Ratio 4.0		Aspect Ratio 4.0	
	Ratio $\frac{h}{c}$ = 0.5		Ratio $\frac{h}{c}$ = 0.5		Ratio $\frac{h}{c}$ = 1.0	
	Cantilever 33%		Cantilever 32%		Cantilever 32%	
	Bay 1-2 67%		Bay 1-2 68%		Bay 1-2 68%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1	11.2	8.95	11.78	9.45	13.2	10.3
Span 1-2	15.3	11.87	14.05	10.94	18.3	14.0
Joint 2	11.6	9.28	10.95	8.71	12.2	9.5

The economical proportions for this case are a cantilever 32½ per cent and a bay 67½ per cent of the half wing span. These proportions are not affected by the slope of the strut since the change in compression equally affects joint 1 and joint 2. The strut slope does, however, affect the strength of the spar and the greater the slope of the struts the greater the factors of safety in the spars.

The moments at joints 1 and 2 were figured for two cases with an aspect ratio of 5, and their relations indicated that the economic location of the strut point for this aspect ratio was the same as for an aspect ratio of 4.

Case III. With center bay and spar continuous. (See Fig. 6.)

This case was figured only for an aspect ratio of 5, and a ratio of "h" to "c" of 0.8. These are average figures, and it was believed that the effect of changing the aspect ratio and the ratio of "h" to "c" in the first two cases had been so small that it was unnecessary to compute their effect in this case. Five trials were made and the following factors of safety were found:

	Trial 1		Trial 2		Trial 3	
	Cantilever 24.8%		Cantilever 24.8%		Cantilever 25.6%	
	Bay 1-2 52%		Bay 1-2 52.8%		Bay 1-2 52.8%	
	½ Bay 2-3 23.2%		½ Bay 2-3 22.4%		½ Bay 2-3 21.6%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1	12.92	10.37	12.92	10.37	12.18	9.72
Bay 1-2	15.10	11.50	14.00	10.53	14.15	10.75
Joint 2	11.80	9.70	12.00	9.85	12.50	10.20
Bay 2-3	17.12	13.90				

	Trial 4		Trial 5	
	Cantilever 24.8%		Cantilever 25.6%	
	Bay 1-2 53.6%		Bay 1-2 53.6%	
	½ Bay 2-3 21.6%		½ Bay 2-3 20.8%	
	Front	Rear	Front	Rear
Joint 1...	12.92	10.36	12.18	9.72
Bay 1-2..	13.18	9.93	13.20	10.00
Joint 2...	12.10	9.90	12.58	10.31

Trial 4 gave the best results, and the proportions recommended are 25, 53½, 21½. A study of the five trials shows that the strength of joint 2 is increased and joint 1 decreased by an increase in the length of the cantilever. The strength of joint 1 and, within the limits of these trials, the strength of joint 2 is unaffected by a change in the relative proportions of bays 1-2 and 2-3. The strength of the bays is chiefly dependent on their length, though an increase of the cantilever at the expense of bay 2-3 strengthens bay 1-2.

Single Bay Biplane

Case I. 30 in. center span; hinged at joint 2. (See Fig. 7).

This case was computed for a machine with a gap-chord ratio of 1.00, the two wings alike, and aspect ratios of 4.6 and 6.6.

	Case a		Trial 1, Case b		Trial 2, Case b	
	Aspect Ratio 4.6		Aspect Ratio 6.6		Aspect Ratio 6.6	
	Cantilever 36%		Cantilever 37%		Cantilever 36%	
	Bay 1-2 64%		Bay 1-2 63%		Bay 1-2 64%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1	9.1	7.3	3.72	2.98	3.90	3.13
Bay 1-2	9.4	7.1	3.84	2.84	3.44	2.48

The values given are for the upper wing only. The lower wing values would be higher as there is no compression in the lower wing spars. The proportions recommended are 36 to 64 for an aspect ratio of 4.6 and 37 to 63 for an aspect ratio of 6.6.

It will be noted in comparing this case with Case I of the monoplane that the bay 1-2 is shorter in the biplane than in the monoplane. This is due to the larger aspect ratio of the biplane and to the fact that the stress from the lower wing increases the compression in bay 1-2. This is partially counteracted by the greater slope of the lift wires of a biplane of a given aspect ratio as compared with the slope of the struts of a monoplane of the same aspect ratio.

Case II. 30 in. center span; continuous at joint 2. (See Fig. 7).

This case was computed with an aspect ratio of 5.6, a gap-chord ratio of 1.0 and the two wings alike. Two trials were made and the following factors of safety obtained for the upper wing spars.

	Trial 1		Trial 2	
	Cantilever 32.8%		Cantilever 34%	
	Bay 1-2 67.2%		Bay 1-2 66%	
	Front	Rear	Front	Rear
Joint 1...	6.73		6.37	5.15
Bay 1-2..	6.27		6.80	5.18
Joint 2...			9.54	7.96

The proportions recommended are 34 and 66. The effect of continuity, it will be noted, is to increase the economic length of the bay 1-2. The proportions will not be greatly changed by a change in the aspect ratio.

Case III. Center span greater than 30 in. spars continuous throughout. (See Fig. 8).

In Case II the joint 2 and bay 2-3 were so much stronger than the joint 1 and the bay 1-2 that an investigation was made to determine the most economical location of the strut points when the center span varied. The gap-chord ratio was 1.0. The lengths of cantilever and bay 1-2 were kept the same in both wings, while the length of the center span was varied in the upper wing but kept at 30 in. in the lower, as shown in Fig. 8. As in the other cases of the biplane, the lower wing has little or no direct compression in its spars and may be disregarded. The factors of safety for the upper wing are as follows:

	Trial 1		Trial 2		Trial 3	
	Aspect Ratio 5.28		Aspect Ratio 5.32		Aspect Ratio 5.36	
	Cantilever 25 %		Cantilever 23.3%		Cantilever 24.6%	
	Bay 1-2 50.8%		Bay 1-2 51.9%		Bay 1-2 51.5%	
	½ Bay 2-3 24.2%		½ Bay 2-3 24.8%		½ Bay 2-3 23.9%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1	10.37	8.53	11.4	9.37	10.25	8.35
Bay 1-2	12.7	9.75	10.5	8.3	10.9	8.32
Joint 2	10.16	8.65	9.45	7.8	9.75	8.14
Bay 2-3	11.8	9.43	11.5	9.2	11.95	9.60

	Trial 4		Trial 5	
	Aspect Ratio 5.28		Aspect Ratio 4.00	
	Cantilever 25 %		Cantilever 25 %	
	Bay 1-2 52.3%		Bay 1-2 52.3%	
	½ Bay 2-3 22.7%		½ Bay 2-3 22.7%	
	Front	Rear	Front	Rear
Joint 1...	10.28	8.40	17.84	14.53
Bay 1-2..	10.57	8.00	20.4	15.68
Joint 2...	10.17	8.43	17.73	14.65
Bay 2-3..	13.90	11.7	28.9	24.6

Inspection of these figures shows that for an aspect ratio of about 5.3, the proportions 25—52.3—22.7 and 25—50.8—24.2 give about equal results. In the former case the bay 1-2 is of about the same strength as the joints and the bay 2-3 considerably stronger. In the latter case the bay 1-2 is stronger than the bay 2-3. The values recommended are 25 per cent, 51½ per cent and 23½ per cent. This case is very much the same as Case III of the monoplane, and the deduction concerning the monoplane apply also to the biplane. Trial 5 shows that a change in the aspect ratio has little effect on these proportions.

Case IV. Without center span; hinged at joint 2. (See Fig 9).

This is the same as Case I, as the shorter lower wing will have no appreciable effect on the location of the strut.

Case V. Without center span; continuous at joint 2. (See Fig. 9).

This is very similar to Case II of the monoplane. The computations are the same, in fact, for the biplane with a gap-chord ratio of 1.00 and the monoplane with a ratio of "h" to "c" of 0.5. For any given ratio of cantilever to bay 1-2 the factors of safety are the same in both cases. The recommended proportions for the two cases are 32½ and 67½.

Where the interplane struts are vertical the spars of the lower wing carry no direct compression, and the economical location of the strut point in the lower wing is changed. As there is no compression, the factor of safety of a spar varies inversely as the bending moment and the economical strut location can be found by a comparison of the moments. This was done for the lower wing of Case I with the following results:

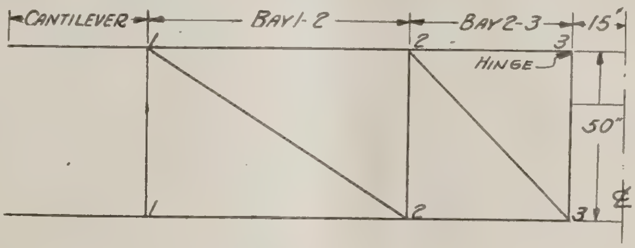
	Trial 1	Trial 2	Trial 3
	Aspect Ratio 6.6	Aspect Ratio 6.6	Aspect Ratio 6.6
	Cantilever 37%	Cantilever 33⅓%	Cantilever 30%
	Bay 1-2 63%	Bay 1-2 66⅔%	Bay 1-2 70%
M_1	3263 in. lbs.	2625	2096
M_{1-2}	1693 in. lbs.	2297	2824

	Trial 3	Trial 4
	Aspect Ratio 6.6	Aspect Ratio 4.6
	Cantilever 32%	Cantilever 32%
	Bay 1-2 68%	Bay 1-2 68%
M_1	2408	1022
M_{1-2}	2544	1161

The ratio recommended is 32½ per cent cantilever and 67½ per cent bay. Both wings could be designed for the most economical strut points if they are not required to be alike. Thus in Case I the upper wing might have a cantilever of 36 in. and a span 1-2 of 64 in., while the lower wing had a cantilever of 31.8 in. and a span 1-2 of 64 in. Both wings would then have the struts at the most economical location and the bay 1-2 would have the same length in each wing.

Two Bay Biplane

Two cases of the two bay biplane (See Fig. 10) were considered. One with zero per cent, and the other with 30 per cent stagger. The gap-chord ratio was taken equal to 1.0. Drift stresses were considered, assuming the resultant 8° back of normal to the chord at high incidence and 7° forward of normal at low incidence. In both cases the lift wires in the inner bay were assumed in a vertical plane. Both wings were taken hinged at the body. The aspect ratio was 7.0 with a 30 in. center span.



BIPLANE, TWO BAY

FIG 10

The factors of safety for three trials were as follows:

	Trial 1		Trial 2		Trial 3	
	Stagger zero %		Stagger zero %		Stagger 30%	
	Cantilever 23.1%		Cantilever 24.4%		Cantilever 24.4%	
	Bay 1-2 45.6%		Bay 1-2 45.6%		Bay 1-2 45.6%	
	Bay 2-3 31.3%		Bay 2-3 30.0%		Bay 2-3 30.0%	
	Front	Rear	Front	Rear	Front	Rear
Joint 1	8.45	6.86	7.74	6.24	7.83	6.00
Bay 1-2	9.36	7.20	10.04	7.89	11.00	6.54
Joint 2	6.70	5.81	6.95	6.11	7.21	5.71
Bay 2-3	7.19	6.00	7.50	6.35	7.24	6.00

The proportions 24½—45½—30.0 are recommended for both cases. Apparently stagger has very little effect on the economic location of the struts in the two bay plane.

Three Bay Biplane

Two cases of the three bay biplane (See Fig. 11) were considered. In both cases the aspect ratio was 9.0, and the gap-

Increase Your Income and Help Aeronautics By

BELIEVING that we can do more for the development of aeronautics by establishing an **Aeronautic Circulating Library in every community** than by any other method, not excluding large government appropriations, we invite the co-operation of progressive men and women, readers of this magazine, who would like to participate in this progressive movement **by establishing an Aeronautic Circulating Library in their community,** which will become a center and clearing house of aeronautic activities in their community, just as the **Aeronautic Library** of New York has been the clearing house of aeronautic activities in New York.

Six years of experience have proven that an Aeronautic Library is a powerful factor and the headquarters of aeronautic activities with far-reaching influence.

More people visit our Bookshop at 299 Madison Avenue, New York City, each day than visit ten clubs. These people come and write from every part of the world, ask our advice, guidance and information—which we gladly supply.

The Aeronautic Library was founded in 1914, as a philanthropic information bureau and free library. Then the demand for books became so large that the purpose had to be extended to include the publishing and selling of aeronautic books, magazines and maps and the distribution of aeronautic articles of a literary, scientific or artistic character; to seek, collect, distribute and make public authentic information relating to our nation's aeronautic needs; to foster the upbuilding of our aerial defenses, encourage scientific research, develop the national aeronautic resources and arouse active public interest in aerial travel and aerial transportation.

As very little existed at that time in the direction stated above, we had to do the pioneer work in this line—which we undertook with pleasure. We started out to be purely a philanthropic service organization, but the demand for aeronautic books and magazines alone became so large as to make the Library an extensive business enterprise.

People of all classes and all ages come to our Bookshop. They know they are welcome; and we are glad to supply them with information and advice. They can look over and read books and magazines free of charge, and read the latest aeronautic news on the bulletin board. Inventors and experimenters bring us their models and exhibit them in our Shop. Aviators come to plot out their flights on our maps, and like engineers, and students and others, come regularly to buy the latest copies of "Aerial Age Weekly", "Flying", "Air Power", and other magazines and the latest books and aeronautic maps. Scores of men, women and young people come to borrow books, buy flying model aeroplanes, aluminum model planes to be used as automobile radiator ornaments, statuettes, aeronautic jewelry, and other aeronautic articles and souvenirs.

Often a limousine stops at the Library and a young boy or girl comes in, accompanied by the father or mother, to buy a toy aeroplane. Soon they become interested in the many aeronautic things they see and end by booking for aeroplane flights, joining the Aerial League of America, acquiring aeronautic books and a "Winged America" for their library, an aluminum model aeroplane for their automobile radiator cap, subscribe to aeronautic magazines. They then go forth into the world to carry the wonderful message of aerial progress, which sends us other people who invariably do likewise.

Banks call to inquire regarding the standing of firms and individuals; exporters inquire about manufacturers who can supply planes, motors, and accessories; lawyers send their clerk to consult the textbook on Aerial Laws and inquire regarding the latest legal decisions; insurance companies call for data on aeronautic risks; chambers of commerce and committees call to find what aviators are available for exhibition flying, and for information about requirements for landing fields; prospective buyers call to find out where they can buy aeroplanes, motors and accessories of all kinds. During the war scores of young men would call to find out how to join the Air Service, and relatives would even call to inquire whether we knew the whereabouts of their boys overseas, or to ask how they could assist their boys in passing their examinations, getting advance training, get transfers to better fields, get their flying pay. Others would seek information as to how they could help to obtain larger aeronautic appropriations, how they could effectively oppose the cutting of the flying pay, etc., etc.

The secret of our success has been that we have rendered and are rendering valuable service in a pioneer and distinctive line of human endeavor.

INCOME FROM AERONAUTIC LIBRARY WILL MORE THAN PAY FOR OFFICE AND CLERK FOR LOCAL AERO CLUB OR AERIAL LEAGUE

IT is a fact that many automobile clubs derive substantial incomes from the sale of maps, guides, gasolene and supplies.

Many Aero Clubs and Aerial Leagues would be established and would be able to do effective work if they could support an office and a clerk. This they can do by establishing an aeronautic library in connection with the Aero Club or Aerial League offices. The Library's customers will become members of the organization and the members of the organization will become customers of the Library. One helps the other—and both help the development of aeronautics.

If you have not as yet an Aerial League in your community write to Major Charles J. Glidden, Aerial League of America, 280 Madison Avenue, New York City, who will be glad to advise you how you can organize a section of the Aerial League of America in your community.

ing an Aeronautic Library In Your Community

HOW YOU CAN ESTABLISH AN AERONAUTIC LIBRARY AS A PROFITABLE AND PERMANENT BUSINESS

YOU can establish an Aeronautic Library (which will bear the name of your community) in connection with almost any activity in which you are engaged, if you have a shop or an office to use, or you can establish it in partnership with the local newspaper, hotel, book or stationery shop, insurance, real estate, or other similar enterprise.

The Pensacola, Florida, Aeronautic Library is located in the Hotel San Carlo, the leading hotel there; the Cincinnati Aeronautic Library is operated in connection with the Pan-American Aircraft Company; the Manila (Philippine Island) Aeronautic Library is connected with an aeroplane agency; aeronautic libraries are being established in China, Brazil, and Bolivia in connection with aircraft agencies, one is being established in Texas in connection with an Aero Club. An Aeronautic Library makes an attractive addition to almost any business or organization.

For less than one thousand dollars we establish your Library and supply you with the necessary stock of aeronautic books, magazines, maps, art works, model aeroplanes, aeronautic jewelry, propeller clocks, goggles, and other aeronautic novelties and articles required to make your Aeronautic Library attractive and complete. We advertise your Library free in our advertisements, so that all the people interested in aeronautics in your community will call on you and become your customers—and also become members of your Aerial League, if you decide to organize a League.

Your Library thereupon becomes not only the aeronautic center and clearing house in your community, but also the distributor and selling agent for all the aeronautic books, including the Aeronautic Reference Library, which consists of six large textbooks dealing with the six main branches of the Aeronautic Science and Art, as follows:

The Textbook of Applied Aeronautic Engineering.

The Textbook of Aerial Laws and Regulations for Aerial Navigation.

The Textbook of Aero Engines.

The Textbook of Naval Aeronautics.

The Textbook of Military Aeronautics.

The Aero Blue Book and Aeronautic Directory.

Also distributor for the following aeronautic magazines and maps; and articles:

AERONAUTIC MAGAZINES:

(1) "FLYING" (monthly), founded 1911, the largest and leading aeronautic magazine in the world which gives a broad survey of developments of aeronautics the world over. $4.00 a year; foreign $1.00 extra.

(2) "AERIAL AGE WEEKLY," founded 1912, the national aeronautic technical and trade paper which gives technical articles by leading authorities, and reports all current events and business prospects in aeronautics. $5.00 a year; foreign $2.00 extra.

(3) "AIR POWER" (monthly), founded 1915, publishes articles by leading authorities on military and naval aeronautics and illustrated review of world progress in military and naval Aeronautic Art and Science. $3.00 a year; foreign $1.00 extra.

AERONAUTIC MAPS:

(1) Official Aeronautical Wall Map of U. S. and Canadian Airways, giving the geographical aeronautical divisions of the North American Continent, the rules of the air, etc., $5.00 a copy. 50 x 43 inches, giving names of all communities on the Airways.

(2) Official Wall Map of the World's 1,100 Airways, with distances between places in miles and kilometers all over the world, connections between air lines and steamship lines and railroads, magnetic deviations, longest periods of daylight at different latitudes, etc. $5.00 a copy.

(3) Aeronautic Maps of different airways and portions of the United States.

MODEL AEROPLANES:

Model aeroplanes guaranteed to fly, different sizes and prices.

The "Liberty" automobile aluminum Radiator Cap Ornament, which is supplied in two types:

Type "A" with Automobile Radiator Cap Attachment, price $5.00.

Type "B" Paper Weight and Desk Ornament, price $6.00.

Also distributors and selling agents for propeller clocks, aeronautic jewelry, souvenir miniature propeller paper knives, rare aerial mail stamps with the cancellations of all the first aerial mail trips, which will attract all the stamps collectors in your community and other attractive articles and novelties for which there will be a large sale, especially during the Thanksgiving, Christmas and New Year's seasons.

For some of these aeronautic books there is a wide demand. For instance, every lawyer, insurance agent and doctor in your community should have a copy of the Textbook of Aerial Laws, because it is the only book that gives the adopted international, national and state aerial laws, aerial insurance information and international air medical standards.

Your chamber of commerce, city officials, banks, newspapers and business men and other people will want the wall map of the airways, which shows on that airway where your community is located.

A great many progressive people will want books and magazines because they want to be connected with the aeronautic movement in this pioneer stage, when it is beginning to extend its usefulness to every branch of human endeavor, and the tremendous strides forward of aeronautics open wonderful possibilities for the employment of ingenuity, genius and skill and business opportunities as great as were opened by the railroad, automobile and telegraph industries. And there are problems of engineering as huge as were solved by the world's master builders; juridical questions to be decided as stupendously difficult as a statesman ever was called upon to settle; possibilities for the development of international relations greater than were ever conceived; problems of transportation to be solved by the application of aircraft as complex as have ever confronted economists; opportunities to gain distinction dazzling enough to satisfy the most ambitious.

Every automobile owner is a prospective buyer of an aluminum plane for his automobile radiator cap; and every boy is a prospective buyer of model aeroplanes, and you can teach boys to fly these models and organize them in teams and arrange to have them compete for the Aerial League of America's trophies and prizes offered for model contests.

Your Aeronautic Library will make you the Community's Aeronautic Advisor and will lead to popularizing aeronautics, establishing landing fields, standardizing aerial laws and regulations and insurance rates, extension of aerial mail service, creating demand for aerial transportation and to other important developments which will help the progress of aeronautics and of your community.

If you are ready to establish an Aeronautic Library in your community write for full information to

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299 Madison Avenue New York City

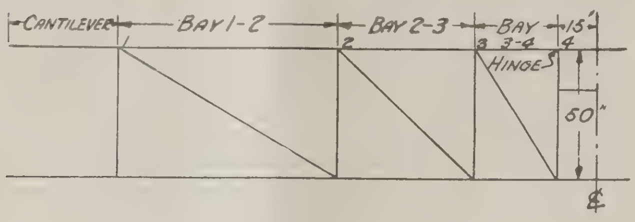
chord ratio 1. The center bay was 30 in. and the joints at the center were assumed hinged. Both wings were alike. The resultant at high incidence was assumed normal to the chord in both cases. The resultant at low incidence was taken as normal to the chord in the first case and 7° in front of normal in the second. The factors of safety for the front spar were the same in both cases. Only one trial was made, and the following results were obtained:

Cantilever	20 %
Bay 1-2	40 %
Bay 2-3	24.8%
Bay 3-4	15.2%

	Front	Rear Case I	Rear Case II
Joint 1	6.64	5.37	5.30
Bay 1-2	7.16	5.35	4.91
Joint 2	5.93	5.10	4.82
Bay 2-3	7.85	6.40	5.48
Joint 3	5.90	6.27	5.50
Bay 3-4	6.38	5.85	5.05

No other trial was made as these proportions are about as good as can be obtained. A small change in the proportion of the three bays without changing the cantilever would have little effect on the results.

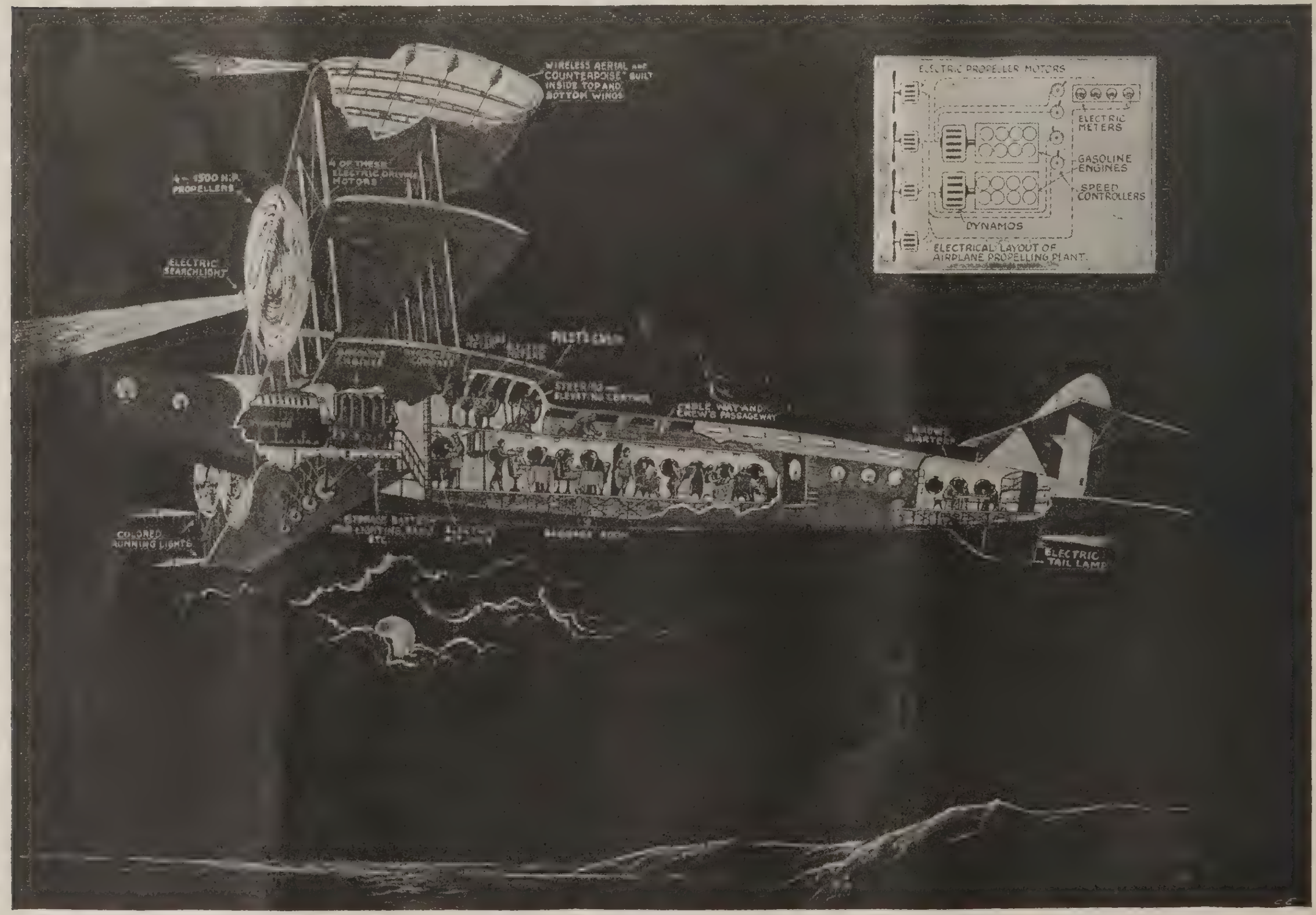
In an aeroplane of this size the geometrical properties of the spars have an appreciable effect on the economical location of the struts, making the values less definite than for smaller aeroplanes. It would be possible to increase the length of the inner bays if the routing were omitted in them.



BIPLANE, THREE BAY
FIG. 11

CAN A SUCCESSFUL ELECTRICALLY DRIVEN AEROPLANE BE PRODUCED?

The accompanying drawing from the *Electrical Experimenter* shows an interesting plan for an electrically driven aeroplane of 6,000 horsepower, based on the statements made to officials of the Aero Club of America and Aerial League of America at Chicago, by an inventor who stated that he had designed and was building an electrically driven plane.


WIRELESS AERIAL AND COUNTERPOISE BUILT INSIDE TOP AND BOTTOM WINGS
4 - 1500 H.P. PROPELLERS
4 OF THESE ELECTRIC DRIVING MOTORS
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CABLE WAY AND CREW'S PASSAGEWAY
CREW'S QUARTERS
COLORED RUNNING LIGHTS
ELECTRIC TAIL LAMP
ELECTRIC PROPELLER MOTORS
ELECTRIC METERS
GASOLINE ENGINES
SPEED CONTROLLERS
DYNAMOS
ELECTRICAL LAYOUT OF AIRPLANE PROPELLING PLANT.

AERIAL ROUTE TRAFFIC CONTROL BY RADIO TELEPHONY

The British Air Ministry has issued the following instructions:

(1) **Radio-Telephony**—Radio-telephone stations are open for work at Croydon and Lympne for the London-Paris and London-Brussels routes. The French authorities have also installed similar stations at St. Inglevert, Valenciennes and Paris (Le Bourget), and the Belgian authorities are arranging to install one at Brussels (Evere).

(2) Stations will shortly be opened for the London, Birmingham, Manchester, Glasgow route at Castle Bromwich, Didsbury and Renfrew.

(3) The wireless control of all the British stations, including stations licensed on private aerodromes, will be carried out by Croydon.

(4) Wavelength, 900 meters.

(5) Procedure as in appendix should be used.

(6) Telephony will be used primarily for giving information as to the whereabouts of an aircraft traveling or about to travel along a route; secondly, for reporting weather conditions along the route to the machine.

(7) **Routine**—Hours of watch for British stations are 0630 to 1930 G.M.T. (0730 to 2030 B.S.T.). The foreign authorities have kindly consented to put their stations in operation if due notification is given.

When aircraft fitted with radio-telephones are scheduled to leave London notification must be sent to C.A.T.O., Croydon, as early as possible on the day of flight, and in any case at least one hour before starting. The C.A.T.O., Croydon, is responsible for advising stations along the route of the name (distinguishing signal) of the aircraft and time of departure.

This notification is to be done as follows:

Taking as an example Handley Page G.E.A.M.A., with telephony, scheduled to leave Cricklewood at 0930 for Paris. As soon as C.A.T.O., Croydon, receives notification, he informs Lympne and the French stations as follows:

"Handley Page G.E.A.M.A., Cricklewood to Paris, 0930."

Lympne passes this message to St. Inglevert; St. Inglevert passes it to Paris. All stations are thus warned for the light.

The Aircraft—Immediately after leaving its aerodrome, calls Croydon and passes the following message:

"Handley Page G.E.A.M.A. clear Cricklewood to Paris."

Croydon replies:

"Clear to Lympne."

The aircraft, when approaching Lympne and about twenty miles away, calls Lympne and passes the following message:

"Handley Page G.E.A.M.A., London to Paris."

Lympne replies, if the weather conditions at St. Inglevert, according to the last report received from that station, are favorable:

"Clear to St. Inglevert."

If unfavorable, Lympne replies in accordance with its latest report from the latter station—*e. g.,* thick fog in Channel, clear south of St. Inglevert; or Channel clear, thick fog St. Inglevert to Abbeville, clear south of Abbeville.

On approaching St. Inglevert, the aircraft reports in the same way and receives a similar reply; again on approaching Paris the aircraft reports in a similar manner. Paris replies:

"Clear to land."

If conditions prevent the aircraft from landing at Le Bourget, Le Bourget replies to this effect and gives necessary instructions. The French language should be used for foreign stations.

(8) All radio-telephonic conversation must be kept as short and concise as possible.

APPENDIX, RADIO-TELEPHONY

Method of Calling Up and Procedure for Two-way Working

(1) **General**—All stations normally "listen out" on their assigned wavelength at their routine times.

In the following remarks on procedure an * indicates change over of the "receive"/"transmit" switch at a station to the position corresponding to its required function at that moment.

(2) **Call Signs**—(This matter is under discussion at the present.)

(3) **Procedure**—Ground to air and *vice versa:*

The following illustrates the procedure adopted for work between a ground and an air station where preliminary tuning is probably required—

Station A has a message for Station B:

*A calls up: Hullo B. Hullo B. A calling. A calling. I have a message for you. I have a message for you. A changing over.

B replies: Hullo A. Hullo A. Hullo A. B answering. B answering. Please pass your message. Please pass your message. B changing over.

*A replies: Hullo B. Hullo B. Hullo B. A answering. A answering. Message begins. Message begins. To ——. From ——. (repeats message). Message ends. Message ends. A changing over.

*B replies: Hullo A. Hullo A. Hullo A. B answering. B answering. Your message begins. Your message begins. Message. Your message ends. Your message ends. B changing over.

*A replies: Hullo B. Hullo B. Hullo B. A calling. A calling. That is correct. That is correct. B. good-bye. A switching off.

(4) **Procedure**—Ground to ground. The following abbreviated procedure to be used between ground stations, A and B keeping constant watch, and no tuning therefore required:

*A calls up: Hullo B. Hullo B. Hullo B. A calling. A calling. I have a message for you. I have a message for you. Message begins. Message begins. To ——. From ——. (repeats message). Message ends. Message ends. A changing over.

*B. replies: Hullo A. Hullo A. Hullo A. B. answering. B answering. Your message begins. Your message begins. Message. Your message ends. Your message ends. B changing over.

*A replies: Hullo B. Hullo B. Hullo B. A answering. A. answering. That is correct. That is correct. B. good-bye. A. switching off.

(5) **Repetitions**—In the event of the repetition of the whole or part of a message being requisite, this will be asked for as required, as also any request to wait on account of interference or other reason.

BRITISH AERIAL NAVIGATORS' CERTIFICATES

The British Air Ministry has issued the following notice to airmen:

With the development of air travel the science of air navigation is of growing importance, and regulations have accordingly been drawn up laying down the qualifications required to obtain Aerial Navigators' Certificates, or Licenses to navigate a civil passenger or goods aircraft under the Air Navigation Regulations, 1919, Schedule 2 (4).

Provision has been made for five classes of certificates:

Aerial Master Navigator.
Aerial Navigator, first class.
Aerial Navigator, second class.
Aerial Navigator, third class.
Aerial Navigator, fourth class.

The qualifications required to obtain each certificate are as follows, but it should be noted that before a candidate is allowed to secure any of the three higher certificates he must have qualified first as an Aerial Navigator, 4th Class:

Aerial Master Navigator

(1) *Must pass Calshot R.A.F. Course on an examination based on Calshot Course—Syllabus D*—subsequent to March, 1920, have had 100 hours' experience of navigation in the air, and be qualified in the theory of navigation at a standard similar to that required for a naval navigator 2nd Class Ships, and/or

(2) Must be qualified as navigator, 1st Class Ships, with not less than sixty hours' experience of navigation in the air, including a five-hour test flight by day over the sea, out of sight of land, and the use of the sextant D.F. W/T, and such further tests as may be ordered, and/or

(3) Must hold Board of Trade Master's Certificate with not less than sixty hours' experience of navigation in the air, including a five-hour test flight by day over the sea out of sight of land, and the use of the sextant D.F. W/T, and such further tests as may be ordered.

Aerial Navigator, 1st Class

(1) *Must pass Calshot Course or an examination based on Calshot Course—Syllabus D*—subsequent to March, 1920, and be certified competent as an aerial navigator, 1st Class, and/or

(2) Must be qualified as a navigator, 1st Class Ships, with not less than forty hours' experience of navigation in the air, and/or

(3) Must hold the Board of Trade Master's Certificate with not less than forty hours' experience of navigation in the air.

Aerial Navigator, 2nd Class

(1) Must be qualified as a navigator, 2nd Class Ships, with not less than twenty hours' experience of navigation in the air, and have passed satisfactorily a test flight with examiner, and/or

(2) Must hold a Board of Trade Mate's Certificate with not less than twenty hours' experience of navigation in the air, and have passed satisfactorily a test flight with examiner, and/or

(3) Must hold the Royal Geographical Society's Diploma in astronomy, including the use of the sextant, with not less than fifty hours' experience of navigation in the air, and have passed satisfactorily a test flight with an examiner, and/or

(4) Must have passed Andover R.A.F. Higher Navigation Course between September, 1919, and February, 1920, and be qualified as Aerial Navigator, 2nd Class, and/or

(5) Must pass an examination based on Syllabus C, have had more than fifty hours' experience of navigation in the air, and passed satisfactorily, a test flight with an examiner.

Aerial Navigator, 3rd Class

(1) Must have passed Andover R.A.F. (Day and Night) Course since May, 1918, with a V.G. Report and have had more than 100 hours' air experience including not less than fifteen hours' night flying, and/or

(2) Must have passed an examination based on Syllabus B, and have had more than 100 hours' air experience with not less than fifteen hours' night flying.

Aerial Navigator, 4th Class

(1) Must have passed Andover R.A.F. Course since May, 1918, with a V.G. report, and had 100 hours' air experience.

(2) Must have passed Stonehenge R.A.F. Course since May, 1918, with a V.G. report, and had 100 hours' air experience.

(3) Must have passed Eastchurch Course since May, 1918, with a V.G. report, and had 100 hours' air experience.

(4) Must pass an examination based on Syllabus A, and have more than 100 hours' air experience.

As the science of air navigation is still in its infancy, it is impossible to fix definitely at the present stage of development final standards of qualifications for the various classes of aerial navigators, and the present tests must therefore be regarded as provisional and as being liable to revision from time to time.

Aerial navigators, 4th Class, will only be licensed to navigate civil aircraft over land by day, those qualified for the 3rd Class certificate will be licensed to navigate over land only by day and night, while those attaining to the higher classes will be licensed to navigate over both land and sea by day and night.

Applicants for any of these licenses must produce a medical certificate in conformity with the Air Navigation Directions, 1919, Section 2 (4-9).

The courses referred to at Andover, Stonehenge, and Eastchurch were R.A.F. Courses available to R.A.F. Officers during a period of the war, and cannot now be taken.

The Calshot Course is that of the R.A.F. Navigation School at Calshot. If found desirable it is possible that this course may be opened to civilians on payment of certain fees. Arrangements have been made to enable candidates who may wish to secure an Aerial Master Navigator's Certificate or a certificate as an Aerial Navigator, 1st Class, to sit for an examination based on the Calshot Course without having to take the course itself. Similar examinations will be held to enable candidates to take certificates under Syllabuses A, B, and C.

There will be two assessments only—"Pass" and "Fail" for the examinations carried out under any of these syllabuses. A "Pass" will be given where a candidate obtains 75 per cent. on the whole examination and not less than 60 per cent. in each subject. If a candidate fails to obtain 60 per cent. in any subject or 75 per cent. on the whole examination, he shall be deemed to have failed in the whole examination and will not be allowed to sit again until at least six weeks have elapsed.

A further announcement will be made later regarding the steps to be taken by those who wish to avail themselves of an opportunity of qualifying for these certificates by examination.

SYLLABUS "A" (AERIAL NAVIGATOR, 4th Class)

Ground Work

Definitions—Sphere, poles, rhumb line, great circle, small circle equator, parallel of latitude, meridians, latitude, longitude, d latitude, d longitude. Course—true, magnetic and compass, drift angle track.

Map Reading—Method of measuring distance and angles on maps and charts. Conventional signs distinctive characteristics. Identifying position by maps and course steered and time aided by a photograph—contours—VI. HE. scales projections, preparation of a map for cross-country flying.

Compass—Magnetic variation and deviation, practical compass correction.

Courses and their corrections.

Flight—Dead reckoning measurement of speed, ground and air. The air speed indicator and computer. The triangle of velocities. Course and distance calculator. Drift bearing plate flying over two known objects to get ground speed and course.

Regulations for Prevention of Collisions in the Air—Aerodrome control. System of lights and day-marks.

Air Work

Practical demonstration of principles learnt in ground work.

(1) Flight by map alone.

(2) Flight by compass alone on predetermined course and time turning point to be indicated—pin pointing.

(3) Flights by drift bearing plate.

Passing out test to consist of a long distance cross-country flight of, say, 150 miles in all.

SYLLABUS "B" (AERIAL NAVIGATOR, 3rd Class)

Ground Work

Definitions—Sphere, poles, rhumb line, great circle, small circle, equator, parallel of latitude, meridians latitude longitude d latitude d longitude. Course—true magnetic and compass drift angle track.

Map Reading—Method of measuring distances and angles on maps and charts conventional signs, distinctive characteristics. Identifying position by maps and course steered and time aided by a photograph—contours—VI., HE., scales, projections, preparation of a map for cross-country flying.

Compass—Magnetic variation and deviation, practical compass correction.

Courses and their corrections.

Flight—Dead reckoning measurement of speed, ground and air. The air speed indicator and computer. The triangle of velocities, course and distance calculator. Drift bearing plate flying over two known objects to get ground speed and course.

Regulations for Prevention of Collisions in the Air—Aerodrome control. System of lights and day-marks.

Air Work

Practical demonstration of principles learnt in ground work.

(1) Flight by map alone.

(2) Flight by compass alone on pre-determined course and time, turning point to be indicated—pin pointing.

(3) Flights by drift bearing plate.

Passing out test to consist of a long distance cross-country flight of, say, 150 miles in all in addition fifteen hours' night flying and a cloud flying test with examiner.

SYLLABUS "C" (AERIAL NAVIGATOR, 2nd Class)

Ground Work

Definitions—Sphere, poles, rhumb line great circle small circle equator parallel of latitude meridians latitude longitude d latitude d longitude. Course—true magnetic and compass; great circle sailing, Mercator's sailing.

Charts and Maps—Conventional signs. Method of measuring distance and angles on them. Mercator's and gnomonic projections.

Compass—Magnetic variation and deviation. Compass correction—practical and theoretical.

Courses and their correction.

Flight—Dead reckoning measurement of speed, ground and air. The air-speed indicator and computer, triangle of velocities. Course and distance calculator, drift bearing plate.

Chronometers—Care of: rating.

Sextants—Reading and use.

Astronomical Definitions—Declination, right ascension, R.A.M.S., equation of time, mean time, apparent time, astronomical time, sidereal time, longitude in time, hour angle, dip, refraction, parallax, altitude, zenith, visible horizon, sensible horizon, rational horizon, ecliptic equinoctial, prime vertical, azimuth, amplitude, position line, intercept.

Star Maps—How to find a star. Method of determining latitude by meridian altitude of sun or star.

Working Observations—1 The summer line; 2 double altitudes.

General—International rules for air and sea navigation. Meteorology. Weather maps. Wind, clouds, general knowledge of the change of meteorological elements.

D.F.N. (Directional Finding Navigation)—Uses of D.F.N. Definitions.

Principles of D.F.H.—Charts required.

Gnomonic projection: principle, construction, etc. Mercator's projection: principle, construction, etc. Conversion angle. Quadrantal error: method of obtaining.

Method of working out bearings. Examples. Position lines and fixes. Laying of bearings to time. Laying of bearings on charts.

Method of working out problems in wind and alteration of course necessary.

Swing of machines. Construction of Q.E. tables.

Lines of equal bearing.

Homing.

Air Work

Must have had fifty hours' experience of navigation in the air by day and twenty hours' night flying.

SYLLABUS "D" (AERIAL MASTER NAVIGATOR AND AERIAL NAVIGATOR, 1st CLASS), METEOROLOGY ADVANCED

Ground Work

Weather Maps—Indication of pressure distribution. How weather maps are prepared. Isobars. Paths and positions of cyclones and anti-cyclones.

Wind—Relation of, to pressure distribution. Weather associated with winds from different directions in typical pressure distributions. Increase of wind and change of direction with height.

Clouds—Determination of height by means of type. Description of different types, conditions of their formation, heights of formations. Flying conditions associated therewith.

General—Conditions favorable for fog, rain, thunderstorms, etc. Relationship of temperature with altitude. Diurnal and nocturnal changes of wind, fog and cloud. Estimation of upper wind from cloud movement. Reading and correction of barometer. Reading of meteorological instruments carried in aircraft. Convection in relation to meteorology. The heating and cooling of the atmosphere. Effect of moisture in the atmosphere. Forecasting over large areas. Formations of rain bands and paths, and their position in relation to depressions.

Mathematics—Plane trigonometry. Spherical trigonometry. Use of mathematical tables. Dynamics (elementary).

General Navigation—Definitions: Use of traverse table, meriditional parts, plane sailing, great circle sailing, mercator sailing.

Nautical Astronomy—The sextant: Use and adjustment. The chronometer. Taking sights of sun (on ground). Determination of index error. Effect of acceleration on a pendulum. Artificial, including gyrostatic, horizons.

The Solar System—Description. Recognition of stars. Definitions (to include): celestial sphere, geographical position, celestial poles, celestial equator, meridians, polar distance, right ascension, zenith, celestial horizon, observer's meridian altitude, zenith distance, azimuth, hour angle.

Time—Time and hour angle. A.T.P. Apparent solar day. Mean sun. Mean solar day. M.T.P. Equation of time. Year. Standard time. Greenwich date. Astronomical day. G.M.T. Change of date. Leap year. R.A.M.S. R.A. Meridian sidereal time.

Altitude and Azimuth—H.A. of heavenly bodies. Star sights (on ground). Use of altitude table and azimuth diagram. Nautical almanac. Determination of true altitude.

General—Solution of spherical triangle with logs. Special slide rule. Veater's and other gnomonic diagrams. Inman's tables. Theory of position lines.

Sights—Star sights in air. Special cases—e.g., equal altitudes, polaris, etc. Moon sights and fixes by star, moon and planet sights. Bubble sextant. Time of sunset and meridian passage.

Directional Finding Navigation

Introduction—Uses of D.F.N. Present and past methods.

Definitions.

Principles of D.F.N.—Charts required.

Gnomonic Projection—Principle, construction, etc.

Mercator's Projection—Principle, construction, etc.

Conversion Angle.

Quadrantal Error—Method of obtaining same.

Method of Working Out Barings—Examples. Position lines and fixes. Laying-off bearings to time. Laying-off bearings on charts.

Method of Working Out Problems on Wind and Alteration of Course Necessary.

Swinging of Machines—Construction of Q.E. tables.

Lines of Equal Bearing.

Homing.

Wireless Telegraphy

Elementary Electricity and Magnetism—Definitions. Static electricity. Method of production. Condenser. Current electricity. Primary and secondary cells.

Magnetism—Permanent magnetism. Magnetized steel. Lines of force. Fields.

Electro-magnetism—Magnetic effect round a straight wire. Effect of coiling wire and adding soft iron core. Comparison with permanent magnet.

Electro-magnetic Induction—Production of electric currents in a wire. Why lines of force should be a varying quantity. Generators. Self and mutual induction. Induction coils. Circuits. High voltage.

Transformers—Construction of primary and secondary coil. "Stepping up" and "stepping down."

Principles of Wave Motion—Æther. Reasons for belief in and comparison with waves of water. Definitions. Laws of pressure waves. Characteristics. Properties of oscillatory circuits.

Oscillatory Circuits—Production of æther waves. Inductance capacity. High-frequency resistance. Relation between spark and oscillation frequency. Relation between wavelength and L.S. value of circuit. Coupling truning. Closed and open circuits.

Transmission Circuits—Diagram and skeleton branch circuit. Function of circuits. Effect of coupling on tuning. Two frequencies in coupled circuits. Tuning to a given wavelength. Transmitting apparatus. Beacon stations and their operation.

Reception—Simple working set and diagrams. Theory Resonance and tuning in receiving sets. Crystal detectors. Telephone receiver. Reception of w/t waves on ordinary aerials. Closed coil used for reception. Amplification.

Valves—Electron theory application. Characteristics of two and three electrode valves. Spark reception. Rectification. Amplification. T.F. receiver. Seven-valve amplifier.

Directional Wireless—Directional qualities of a coil. Decrease in signal strength for angular displacement of coil. Minimum method. Maximum method for aircraft. Fitting of machines. Wing coils.

Quadrantal Error—Cause and method of compensation.

Air Work

Long flights by day and night. Navigating by sextant, and bearings by D.F. w/t.

FOREIGN NEWS

Lloyd's Prepare Aviation Record

The Committee of Lloyd's, recognizing the growing importance of aviation insurance, established some time ago a sub-committee on aviation assisted by a technical committee. The membership of the committees include representatives of the air transport companies, aircraft constructors and underwriters.

It is clear, on the one hand, that enterprise in connection with civil aviation would be greatly assisted by adequate insurance facilities; on the other hand, these facilities cannot be provided unless certain essential information is collected and recorded in an available form. The establishment of a Lloyd's Aviation Record has therefore been approved.

The first part of the Record will be shortly issued to subscribers, bearing information in respect to aircraft and pilots, and it is intended to follow this with further information as to technical, personnel, aerodromes, alighting waters, air routes, foreign laws, etc.

The scope of the Record will be international, and steps are being taken to establish Lloyd's aviation agents and surveyors at home and abroad.

While those desirous of securing information afforded by the Record will be required to subscribe to its maintenance, it is not the intenton to make it more than self-supporting.

It is the policy of the Committee in establishing Lloyd's Aviation Record to create facilities whereby constructors of aircraft, air transport companies and underwriters of aviation risks may equally benefit, and furthermore, it is thought that the benefits arising should tend to assist in the development of civil aviation.

Every effort will continue to be made to secure in the committees responsible for the maintenance of the Record an adequate representation of the various aeronautical interests involved.

Pilots desirous of being enrolled on Lloyd's Aviation Record may apply for a form of application to the Secretary, Lloyd's, Royal Exchange, London, E. C. 3. Similarly, owners of aircraft who may wish to ensure correct information as to their aircraft now being placed upon the Record may procure the necessary form from the same source. Upon return of the form properly completed, the information contained therein will be recorded free of charge.

Greeks Bag an Aeroplane

In the communiqué received in London from the Greek Headquarters at Smyrna, dealing with operations on August 29, about 50 miles S.E. of Philadelphia, it is recorded that one enemy aeroplane was brought down.

The Zeppelin Hangars at Tondern

From Berlin it is reported that the members of the Demobilization Committee, after their recent inspection of the Zeppelin hangars at Tondern, fixed the price for them at 23 million marks. Denmark has been asked if she would like to take them, and in the event of the reply being in the negative they will be dismantled and brought to England.

Aviator Casale, one of the leading French aviators, scheduled to represent France in the Gordon Bennett aviation trophy contest

A Berlin-Amsterdam Service

A new aerial service between Berlin and Amsterdam via Bremen has started. The machines will run three times a week and carry all classes of mail matter. There will be a connection with the service to London at Amsterdam.

New Aerodromes in Spain

The Spanish Minister of Public Works has authorized the laying out of an aerodrome at Lecarte, close to San Sebastian, while another is to be established near Bilboa and the Archanda mountains.

Mlle. Boland's Channel Flight

Mlle. Boland has at last succeeded in her ambition to fly the channel. She left Le Crotez on August 25, her intended destination being Croydon, but had to descend near Lympne, her aeroplane sustaining slight damage.

She has not the distinction of being the first woman to fly across the Channel, as stated in some of the daily papers, this belonging to the late Miss Harriet Quimby, an American pilot, in pre-war days.

General Nivelle Travels by Air

General Nivelle, the hero of the defence of Verdun, paid a week-end visit to London, arriving on August 20 and leaving on the 24th. He traveled each way in a Farman "Goliath" aeroplane, and spent a couple of hours at the London terminal aerodrome prior to his departure.

Italy's Zeppelins

The first of two German Zeppelins, the L61, assigned to Italy, reached Milan from Constance, on its way to the Ciampino Hangar, near Rome. It was manned by Italian officers and a German crew.

No Paris Aero Show

No International Aeronautical Exhibition will take place this year at Paris. The next exhibition has been fixed for 1921 at the Grand Palais. The actual date will be announced shortly.

Missing Aeroplane Discovered

A message has been received from the French Consul at San Sebastian that he has detained a Morane "Parasol," which has landed there and needs a pilot to fly it back to Pau. This machine was stated to have been stolen by an English pilot from the Pau aerodrome.

Hockey Team to Travel by Air

The All-England Women's Hockey Association have received a proposal from France that a French team should be sent to England by aeroplane for a representative match and fly back the same day. The proposal is being favorably considered.

Electioneering by Air

The *Times* correspondent in Melbourne states Mr. Fihelly, the acting Premier of Queensland, is arranging that he and Mr. Theodore, in conjunction at the coming general elections, will carry out an extensive campaign tour by aeroplane.

Proposed Aerial Survey in Calcutta

At a meeting of the Calcutta Improvement Board it was decided to approach the Handley Page Company with the view of obtaining an estimate for the aerial survey of Calcutta. It was also resolved to consult the Corporation as to their willingness to join in the undertaking.

British Bomb Bolsheviks

A message states that the Bolsheviks have landed heavy reinforcements at Enzeli and the Persian Cossacks are retreating from Resht along the Resht-Menuil road.

A later message says that British aeroplanes are co-operating with the Cossacks, and have successfully bombed the Bolshevik ships in Enzeli harbor.

Repatriation of Anzacs

Four aeroplanes, carrying £500,000, collected for the Peace Loan, were engaged in the first Australian Aerial Derby, reported The Times Melbourne correspondent on August 28. The distance, 116 miles, from beyond Bendigo to Melbourne, was covered in 1¼ hours. Only 2¼ minutes separated the first and last machines

Mr. Millen, the Minister of Repatriation, who acted as judge, in a speech of congratulation, said that the whole of the Peace Loan, £25,000,000, would be spent on repatriation.

Spain to Buy British Machines

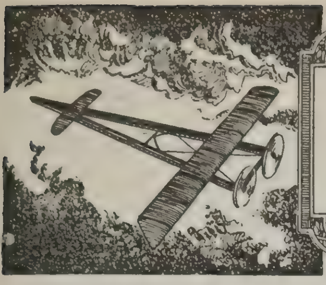
A decree published in Spain, authorizes the Spanish Minister of War to purchase some new Brtish machines of the De Haviland type.

Aeronautics at the Imperial College, England

A comprehensive scheme of instruction and training, mainly postgraduate in character, has been arranged by the Aviation Department of the Imperial College at South Kensington, for next session beginning in October, including special sections in aeronautical engineering, meteorology, and navigation. The staff includes Sir Napier Shaw as Professor of Meteorology; Dr. Leonard Bairstow, Professor of Aerodynamics; Mr. A. J. Sutton Pippard, who will deal with the structure and strength of aircraft, and Mr. A. T. Evans, whose province will be aircraft engines Courses of lectures will also be given dealing respectively with airships and with navigation, while arrangements are in hand for special instruction in air-cooled engines, high-compression engines, dopes, instruments, wireless telegraphy and similar subjects. It has also been arranged that students will carry out part of their practical training in one or other of the Government establishments concerned with aeronautics.

Big Air Load from Brussels

A Goliath machine, owned by the Sneta Company, of Brussels, operating the London-Brussels aero service in conjunction with the Handley Page Company, arrived at Cricklewood Aerodrome from Brussels, carrying eleven passengers and two crew, with luggage.



ELEMENTARY AERONAUTICS
and
MODEL NOTES

By John F. McMahon

Propellers

A propeller must be correct in design and construction if the efficiency is to be anything near 100%. Of course 100% efficiency is never realized, the best propeller giving about 75%, which means if a propeller is one having a six-foot pitch, only 4½ feet will be realized and if the motor is one with a 100 H.P. rating only 75 Horse Power will be utilized.

From photos of models sent in to me by readers I notice that while the model is well built and carefully planned, in most cases the propeller is an ugly looking piece of carving that is a propeller in name only. That is what gave me the idea to put before the readers the necessity of designing and carving propellers with extreme care.

Revolutions Per Minute

Pitch	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
2′ 0″	....	....	....	....	....	.....	.....	22.7	25.0	27.3	29.5	31.8	34.1	36.4	38.6	40.9	43.2	45.4
2′ 6″	....	....	....	....	....	.....	25.6	28.4	31.2	34.1	36.9	39.8	42.6	45.4	48.3	51.1	54.0	56.8
3′ 0″	....	....	....	....	....	27.3	30.7	34.1	37.5	40.9	44.3	47.7	51.1	54.5	57.9	61.4	64.8	68.2
3′ 6″	....	....	....	....	27.8	31.8	35.8	39.8	43.7	47.7	51.7	55.7	59.7	63.6	67.6	71.6	75.6	79.5
4′ 0″	....	....	....	27.3	31.8	36.4	40.9	45.4	50.0	54.5	59.1	63.6	68.2	72.7	77.3	81.8	85.4	90.9
4′ 6″	....	....	25.6	30.7	35.8	40.9	46.0	51.1	56.2	61.4	66.5	71.6	76.7	81.8	86.9	92.0	97.2	102.3
5′ 0″	....	22.7	28.4	34.1	39.8	45.4	51.1	56.8	62.5	68.2	73.9	79.5	85.2	90.9	96.6	102.3	107.9	113.6
5′ 6″	18.4	25.0	31.2	37.5	43.7	50.0	56.2	62.5	68.7	75.0	81.2	87.5	93.7	100.0	106.2	112.5	119.7	125.0
6′ 0″	20.5	27.3	34.1	40.9	47.7	54.5	61.4	68.7	75.0	81.8	88.6	95.4	102.3	109.1	115.9	122.7	129.5	136.4
6′ 6″	22.2	29.5	36.9	44.3	51.7	59.1	66.5	73.9	81.2	88.6	96.0	103.4	110.8	118.2	125.6	132.9	140.3	147.7
7′ 0″	23.9	31.8	39.8	47.7	55.7	63.6	71.6	79.5	87.5	95.4	103.4	111.3	119.3	127.3	135.2	143.2	153.4	159.1
7′ 6″	25.6	34.1	42.6	51.1	59.7	68.2	76.7	85.2	93.7	102.3	110.8	119.3	127.3	136.4	144.9	153.4	161.9	170.5
8′ 0″	27.3	36.4	45.4	54.5	63.6	72.7	81.8	90.9	100.0	109.1	118.2	127.3	136.4	145.4	154.5	163.7	172.7	181.9
8′ 6″	29.0	38.6	48.3	57.9	67.6	77.3	86.9	96.6	106.2	115.9	125.6	135.2	144.9	154.5	164.2	173.8	183.4	193.3
9′ 0″	30.7	40.9	51.1	61.4	71.6	81.8	92.0	102.3	112.5	122.7	132.9	143.2	153.4	163.7	173.8	184.0	187.2	204.6
9′ 6″	32.4	43.2	54.0	64.8	75.6	86.4	97.2	107.9	118.7	129.5	140.3	151.1	161.9	172.7	183.4	194.2	205.0	216.0
10′ 0″	34.1	45.4	56.8	68.2	79.5	90.9	102.3	113.6	125.0	136.4	147.7	159.1	170.5	181.9	193.3	204.6	216.0	227.3
10′ 6″	35.8	47.7	50.7	71.6	83.5	95.4	107.4	119.3	131.2	143.2	155.1	167.0	179.0	190.9	202.9	214.8	226.8	238.7
11′ 0″	37.5	50.0	62.5	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0	12.5	225.0	237.5	250.0
11′ 6″	39.2	52.3	65.3	78.4	91.5	104.6	117.6	130.7	143.7	156.8	169.9	182.9	196.0	209.1	22.2	235.3	248.4	261.4
12′ 0″	40.9	54.5	68.2	81.8	95.4	109.1	122.7	136.4	150.0	163.6	177.2	189.9	204.5	218.2	.31.8	245.5	269.2	272.8

The propeller manufacturing companies who make the "props" for large machines, have a corps of engineers and laboratory workers always working to better their product and make the average aeroplane more efficient.

For models the case is the same, each type of model must have a special design of propeller, for instance, a long distance racing model should have a high pitch medium blade propeller of large diameter, the fast "speed" model should have a medium pitch, etc., the proper one must be decided on by the model builder. I would not try to tell you just which one should be used for a certain model, but would rather have you make a few different kinds for each model to decide which one proves best.

A well known aeroplane manufacturer some years ago would, upon completion of a machine sent about a dozen different types, diameter and pitch of propellers and try each one in turn making a complete record of each performance. In this way the best propeller for the job was used and there was no question as to whether the motor was wasting any of its costly power.

The following table is a list of speeds in miles per hour at different revolutions per minute of propellers having pitch varying from 2 feet to 12 feet. This has been published by the Stone Propeller Company and is intended for large propellers only. These are theoretical and the loss must be deducted from these tables.

. To find the pitch of a propeller refer to Figure 8. Our propeller is 8 inches in diameter, then the tips in one revolution will travel 8 x 3.1416, or 25 inches approximately. Now the width of our blade being 1½ inches, we divide the circumference 25 inches by the width of the blades 1½ inches to find how many widths are contained in the circumference .25 inches divided by 1½ inches = 16⅔ times, or to get even figures we will call it 17 times. Now the thickness of the blank we will use is 1 inch or for every blade width in the circumference the propeller screws its way 1 inch further into the air and by multiplying 1 inch × 17 blade widths we get 17 inches for the pitch.

The screw shown at Figure 5 will help the model builder to grasp what pitch means. We will say this screw is ⅛-inch pitch. This means, if we were to take a screw driver and give the screw one complete turn in the wood, it would advance ⅛-inch, so the propeller in one turn or revolution advances 17 inches. The model maker will remember this method of calculation is only approximate, but it is accurate enough for a model propeller. To figure the pitch of a propeller accurately it would necessitate a great deal of mathematical operations and we would have to calculate the pitch every half inch or so along the blade. The method I have just outlined can be applied to any size of propeller by using the formula

$$\frac{\text{diam.} \times 3.1416}{\text{width of blade}} \times \text{Thickness of blank.}$$

Now that we know how to find the pitch, we will proceed to carve propeller. We will select a block of white pine 10 inches long, 4 inches wide and 1 inch thick. This will give us ample space to work in. We next draw a line accurately in the center of the block as a guide. Now draw lines in each side of this center line 1½ inches from it. Then mark a point exactly half way from top and bottom of block or in this case 5 inches from the top. Now draw a line across the block at this point. Next lay off points on the two side lines 1½ inches from the cross line, now draw a line through the center, connecting the two points, we just laid out. Draw ovals around the center point to mark out the hub, then make circles at the ends of blades to round off the tips, after which round off corners as shown.

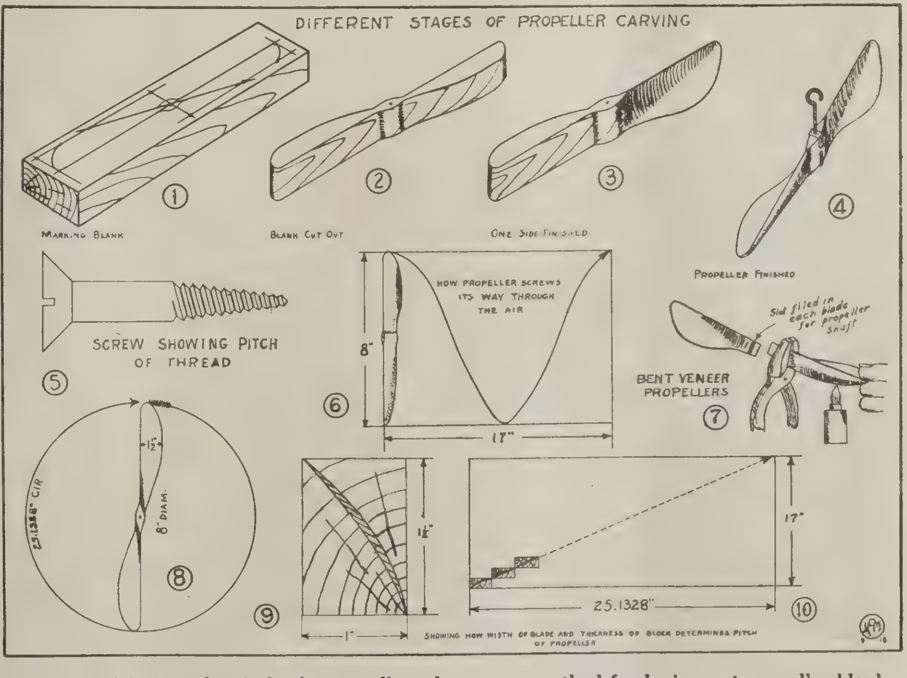
Blank can be cut out by jig saw by following the outside lines or if you cannot procure a jig saw, carve out with a sharp penknife.

To carve, hold blank firmly in left hand and shave off opposite blade with sharp penknife, then give blade a sort of cupped shape. To finish use a rough sand paper. Polish off with fine sand paper. Now repeat the performance with the other blade. When this is done, turn blank over and carve the back of the blades. Be careful not to shave off too much, because there is danger of the blade of the knife cutting through the soft wood. When finished give it three coats of shellac varnish, allowing each coat to dry thoroughly before applying the other. When shellac is dry, drill a small hole in the hub, for the propeller shaft and put into place on the model.

Don't be discouraged if your first propeller doesn't come up to your expectations. It takes a little practice to do a good job. My first propeller was no credit to me, one blade had a greater pitch than the other, but it flew an Antoinette model 75 feet when the model rcord was 178 feet. So you see a model propeller will give some thrust even when made incorrectly, but of course the better workmanship always gives the best results.

The motive power to turn this size propeller consists of 10 strands of ⅛-inch rubber.

Some experienced model builders prefer a propeller built up of two pieces of thin birch veneer, cut to shape and then bent over a flame, by twisting until the proper shape is accomplished. Lapped at the hubs and wrapped with thread and glue. See sketch.


DIFFERENT STAGES OF PROPELLER CARVING
①
Marking Blank
②
Blank Cut Out
③
One Side Finished
④
Propeller Finished
⑤
SCREW SHOWING PITCH OF THREAD
⑥
8"
HOW PROPELLER SCREWS ITS WAY THROUGH THE AIR
17"
⑦
BENT VENEER PROPELLERS
Slot filed in each blade for propeller shaft
⑧
25.1328" CIR
1½"
8" DIAM.
⑨
1½"
1"
⑩
17"
25.1328"
SHOWING HOW WIDTH OF BLADE AND THICKNESS OF BLOCK DETERMINES PITCH OF PROPELLER
JFM
9 18

Method of finding the pitch of a propeller, also proper method for laying out propeller blank

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

"Darn Fool Questions"

Do ships have eyes when they go to sea?
Are there springs in the ocean's bed?
Does the Jolly Tar flow from a tree?
Does the river lose its head?

Are fishes crazy when they go in Seine?
Can an old hen sing her lay?
Can you bring relief to a window pane?
Or mend the break of day?

What sort of a vegetable is a policeman's beat?
Is a newspaper white when it's read?
Is a baker broke when he is making dough?
Is an undertaker's business dead?

Would a wallpaper store make a good hotel?
(Because of the boarders there?)
Would you paint a rabbit on a bald man's head
Just to give him a little hair?

Would you pay a policeman with silver coin?
For nickels aren't made for coppers.
If a grass widower married a grass widow,
Would their children be grasshoppers?

If you ate a square meal would the corners hurt?
Can you dig with the ace of spades?
Would you throw a rope to a drowning lemon,
Just to give the lemon aid?

A. Aeronut.

A native "observer" attached to the British Royal Air Force, suggests we may organize a body of "observers" in the U. S. to "spot" aerial smugglers

A Few Hints for the Would-Be Aviator

By Richard S. Rogers

Never fly without a reversible propeller, so in case you run into some air too heavy for your motor to pull you can back out; then, too, it's great sport flying backwards.

Never go up in a plane without a ladder, for it's not only handy to climb down in case of a spin, but you can stand on it to swing the propeller should your motor go dead in the air.

Never run your motor when more than half the following articles are gone: Cylinders, connecting rods, gears, bolts, nuts, screws, pistons and bearings, as it does not only hurt the appearance of the motor, but may detract from the power slightly.

It is always a good idea to tie a wash-tub to the tail skid to catch pistons, gears, connecting rods, bolts, nuts and screws that fly from the motor when in the air, very often a fellow can make an extra motor or so from these parts.

Never try to take off with a wing gone, as the remaining wing would be too small to lift the plane.

A picket fence will answer for a wing very well. It can be covered with quilts, blankets, newspapers, or in fact most anything except fly-paper. Never cover it with fly-paper as you are apt to get stuck in the air and not be able to come down.

Always tie a safety wire from a strut on each wing to the fuselage, so in case one comes loose you wont lose it.

Never try to land bottom side up, as your watch and change are liable to drop out of your pocket.

However there is one thing in favor of the above landing: you don't have to climb out of the plane; just unfasten your belt, you'll come out alright.

Never wear your sox while flying—they should be used to carry extra gas and oil in.

Always put a sack over the gas tank so if it explodes you will have the parts.

Never catch hold of the propeller while flying unless you are wearing goggles, as there is danger of knocking a piece of varnish off into your eye.

Never hang by your teeth to the wires on the wings, as you are liable to bite into them, causing the planes to collapse.

If you will follow these few simple hints we are sure you will succeed in the aerial world.

Notes from Anti-Air Service

There is no getting around the fact that the aviators were the most swank of our army in France. And you didn't need to tell 'em they were good.

Here is a favorite stunt the war correspondents used to pull on them in Paris:

An aviator, noticing the "C" on a correspondent's brassard, would approach and the conversation would run something in this wise:

"I say, old man, what's the insignia mean that you've got on your arm?"

"That means I'm a correspondent. And, pardon me, but what do the silver wings on your chest stand for?"

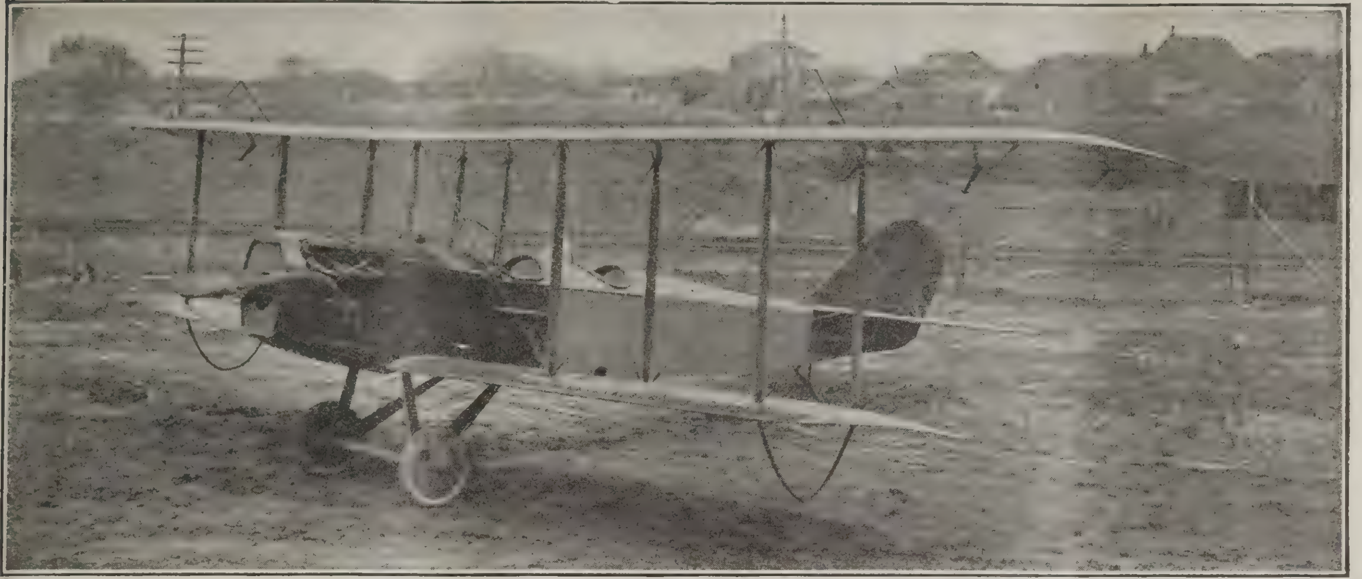
"Why, don't you know? That means I'm an aviator, a pilot."

"Oh, that's it, is it? I didn't know. You see, I've been up at the front all the time."—*The Red Diamond.*

The Heat of Battle

Ensign (as he sees a direct shot scored on the enemy): "Good work! Who fired that shot?"

Gob: The ship's cook, sir. He got the range and stove in her side."



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Harry Hiles, Cheyenne, Wyo., for Southern Wyoming.
Northwest Aircraft Corporation, Newell, S. D., for Western South Dakota.
Erick Aviation Company, Erick, Okla., for Western Oklahoma and Pan Handle.

(*Continued from page* 70)

January in this region there were no days when the wind velocity at any time in 24 hours was below 10 miles per hour and only 4 days when the velocity was between 10 and 20 miles per hour. On the other hand, during 15 days the wind was between 20 and 30 miles; 6 days between 30 and 40 miles; 1 day between 40 and 50 miles; 3 days between 50 and 60 miles, and 2 days when the wind velocities reached between 60 and 70 miles per hour, practically always directly in the face of the westbound planes. Naturally the eastbound planes will drive through the air at enormous speed with such strong winds on the tail, and the eastbound schedules have been laid out to take as much advantage as possible of the high winds blowing from the west.

The Air Mail was inaugurated May 15, 1918, and has been in continuous operation ever since. The first route was between New York and Washington, a distance of 218 miles. The routes between Cleveland and Chicago, and New York and Cleveland, were established in 1919, the route between Chicago and Omaha on May 15, 1920, the route between Chicago and St. Louis on August 16, 1920, and the route between Chicago and Minneapolis on September 1, 1920.

Since its inauguration two years and three and a half months ago, the Air Mail operations covered 957,108 miles of flying. In that time it has carried 38,027,440 letters. The cost of operation, including interest on investment, total or partial wrecking of planes, replacements of damage to planes, death and injury compensation, etc., has been $1,147,926.26 for 2¼ years, or $1.18 per mile. More than one-third of this cost of operation was not cash expenditure but represents the original cost to the Army and Navy of surplus war material which the Post Office Department put to use in carrying the mails. First-class mail has been advanced in delivery to the public 18 to 24 hours.

With the inauguration of the through Trans-continental Air Mail which started on September 8, Postmaster General Burleson has extended the American Air Mail Service over 1,463 miles of new territory, reducing the transit time of mails between New York and San Francisco from 91 hours to 57 hours in the winter months, and to 54 hours in the summer. Preparations are being already made for night flying over the plains next spring between Chicago and Cheyenne, and this will reduce the time of transit of the Air Mail to 45 hours against 91 hours by rail.

The Trans-continental Air Mail Service starts daily from New York and San Francisco simultaneously at 5:30 a. m., local time.

The regular schedule adopted for the service is as follows:

AIR MAIL PLANES—TRANS-CONTINENTAL

	Air Mail Schedule		*Train Schedule*	
Field	*Winter*	*Summer*	*West Bound* No. 35	No. 43
New York	Lv. 6:30 a.m. ET	Lv. 5:30 a.m. ET	8:40 p.m.	2:15 a.m.
Cleveland	Lv. 11:08 a.m. CT	Lv. 10:08 a.m. CT		
Chicago	Ar. 3:27 p.m. Lv. 6:00 a.m.	Lv. 2:30 p.m.	2nd day 8:00 p.m.	2nd day 1:15 a.m.
Iowa City	No stop	Ar. 4:08 p.m. Lv. 5:30 a.m.		
Omaha	Lv. 11:40 a.m.	Lv. 8:45 a.m.	3rd day 10:45 a.m.	2nd day 3:15 p.m.
North Platte	No stop	Lv. 11:11 a.m. MT		
Cheyenne	Ar. 4:25 p.m. MT Lv. 5:30 a.m.	Lv. 2:09 p.m.	3rd day 10:45 p.m.	3rd day 10:30 a.m.
Rock Springs	Lv. 8:43 a.m.	Ar. 5:02 p.m. Lv. 5:30 a.m.		
Salt Lake	Lv. 9:55 a.m.	Lv. 6:42 a.m. WT	(Ogden) 4th day 1:15 p.m.	4th day 10:05 a.m.
Elko	Lv. 12:48 p.m.	Lv. 9:35 a.m.		
Reno	Lv. 4:03 p.m.	Lv. 12:30 p.m.	5th day 2:52 a.m.	
San Francisco	Ar. 6:23 p.m.	Ar. 2:00 p.m.	5th day 12:30 p.m.	

	Air Mail Schedule		*Train Schedule*
Field	*Winter*	*Summer*	*East Bound*
San Francisco	Lv. 6:30 a.m. WT	Lv. 5:30 a.m. WT	9:00 a.m.
Reno	Lv. 9:02 a.m.	Lv. 8:02 a.m.	8:00 p.m.
Elko	Lv. 12:07 a.m.	Lv. 11:07 a.m.	5:10 a.m.
Salt Lake	Ar. 3:31 p.m. MT Lv. 12:00 noon	Lv. 2:51 p.m. MT	5:15 p.m.
Rock Springs	Lv. 2:06 p.m.	Ar. 4:37 p.m. Lv. 5:30 a.m.	
Cheyenne	Ar. 4:50 p.m. Lv. 5:30 a.m.	Lv. 8:33 a.m.	3rd day 6:25 a.m.
North Platte	No stop	Lv. 11:01 a.m. CT	1:20 p.m.
Omaha	Lv. 12:11 p.m.	Lv. 8:36 p.m.	8:55
Iowa City	No stop	Ar. 6:21 p.m. Lv. 5:30 a.m.	
Chicago	Ar. 5:11 p.m. Lv. 5:30 a.m.	Lv. 8:05 a.m.	4th day 12:45 p.m.
Cleveland	Lv. 10:35 a.m.	Lv. 1:10 p.m.	
New York	Ar. 4:00 p.m.	Lv. 6:00 p.m.	5th day 9:40 a.m.

J. L. Metal Monoplanes with a cruising radius of 10 hours at 90 miles an hour are operated between New York and Omaha with a single stop for gassing at Chicago.

De Haviland-4 Planes with four hours' fuel and oil, at 80 miles per hour, are used between Omaha and San Francisco, gassing stations being approximately 200 miles apart.

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AERIAL AGE WEEKLY

l. 12, No. 4 OCTOBER 4, 1920 10 CENTS A COPY

Sopwith Torpedo Carrier of the Cuckoo Type Used By the British Admiralty

$5000 Contest for Designs for Aeroplanes Capable of Carrying Twenty, Fifty, One Hundred, One Hundred and Fifty, and Two Hundred Tons of Useful Load Planned by the Aerial League of America

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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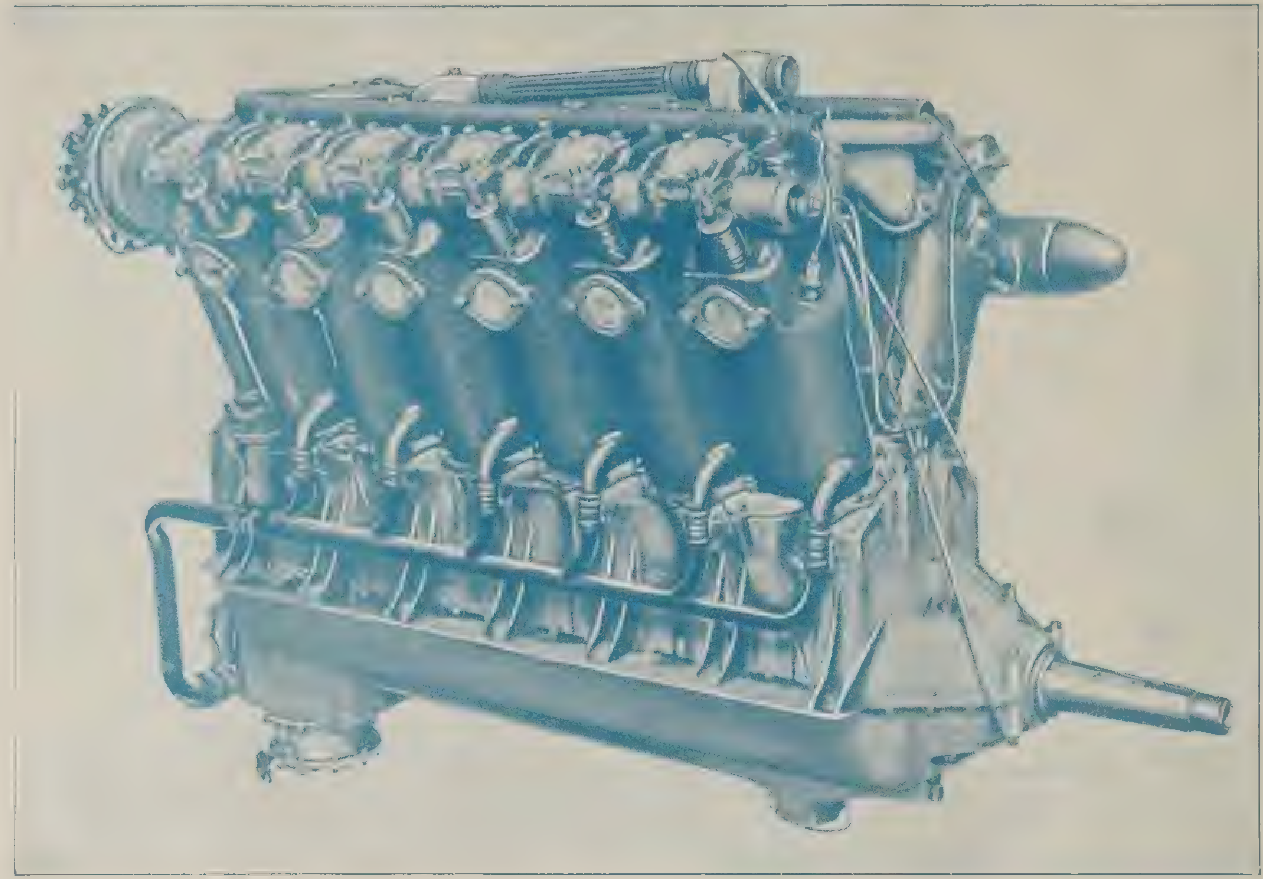

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VOL XII. NEW YORK, OCTOBER 4, 1920 No. 4

$5000 CONTEST FOR DESIGNS FOR AEROPLANES CAPABLE OF CARRYING TWENTY, FIFTY, ONE HUNDRED, ONE HUNDRED AND FIFTY AND TWO HUNDRED TONS OF USEFUL LOAD PLANNED BY THE AERIAL LEAGUE OF AMERICA

BELIEVING that the construction of aeroplanes capable of lifting from twenty to two hundred tons of useful load is possible now on account of recent discoveries in the construction of aeroplane wings and bodies and the general improvements in the construction of aeroplanes brought about by the nation's huge expenditures in aircraft production during the war, which amounted to about five billion dollars, Mr. Henry Woodhouse, through the Aerial League of America, has offered the sum of $5,000 to be awarded in prizes in a contest for designs for aeroplanes capable of carrying twenty, fifty, one hundred, one hundred and fifty and two hundred tons of useful load.

The Aerial League of America will have charge of the contest and in appointing a committee of experts to pass on the ideas and designs will invite the Army, Navy and National Advisory Committee for Aeronautics and Post Office Department to appoint their leading experts on this committee so that the government will have the benefit of getting all the ideas and engineering data submitted in this contest. Further information may be obtained by writing to the Secretary Aerial League of America, 280 Madison Avenue, New York City.

Mr. Woodhouse's Offer to the League

In making this offer through the Aerial League of America Mr. Woodhouse wrote as follows:

"Some recent extraordinary discoveries which permit constructing aeroplane wings that will lift twice as much per square foot as was lifted by wings heretofore constructed, and further discoveries and improvements in general aeroplane construction which minimize head resistance and give greater strength for half the weight, justify believing that it is possible today to construct aeroplanes capable of carrying from twenty to two hundred tons of useful load.

Prominent Engineers Urge Contest

"As a matter of fact, several twenty and fifty-ton aeroplanes have already been designed and at least one twenty-ton air cruiser is under construction.

"Prominent American, English, French and Italian engineers have told me that they are ready to participate in such a contest. They are convinced that aeroplanes can be built now that will lift from fifty to two hundred tons of useful load and are looking for an opportunity to show what they can do.

"I dare say that it will not be more difficult to produce an aeroplane lifting a hundred tons of useful load than it was to produce the first successful aeroplane, the first twin-motored aeroplane and the first transatlantic flyer. I like to believe that we shall not again be troubled by the rigid-minded mathematician and the narrow-minded, theoretical obstructionists who in the past obstructed the way of aeronautic progress. There was, of course, ample justification for Newcomb's arguments against the possibility of an aeroplane being lifted off the ground by means of its own power. Newcomb was justified because it had never been done before; the laws of gravitation seemed to forbid it. While Langley's models demonstrated possibilities, Professor Newcomb was justified in quoting the 'law of the cube' to prove that a full size aeroplane large enough to carry a man could not be made to leave the ground.

Some of the "Impossibilities" Which Have Been Realized

"Langley, who had worked side by side with Professor Newcomb for years, proved that dynamic flight was possible, but the incredulous world disbelieved the proofs and, as a matter of fact, for five years after the Wright Brothers made their first flight, December 17, 1903, the world disbelieved that an aeroplane could actually fly. Some admitted, after a while, that an aeroplane could rise, like a skipping stone, but would be unable to turn in the air. The reports of the Wrights' circular flights before 1908 were not believed, and the circle of Henri Farman in France in 1907 was considered a stunt. Then, in 1908, Wilbur Wright proved beyond doubt in his flights in France that circling was part of flying. He took the word 'impossible' out of the dictionary.

"Eight years ago, when I forecast that in future military operations speed would be one of the principal factors in military aeroplanes, because aeroplanes would be employed for fighting purposes and for bomb-dropping, so-called authorities asked: 'What will you fight with—your fists?'

"I stated that machine guns and bombs would be used, and the technical obstructionists presented mathematic computations to show that the recoil of a gun and the dropping of a bomb weighing more than fifty pounds would upset the aeroplane. We know now that it does not—but that is what they said, and many people believed them, and the progress of aeronautics was delayed by their arguments.

"When I expressed the possibility of equipping aeroplanes with two or more motors I was considered visionary, and again mathematic computations were presented to show:

"(1) That a machine equipped with two motors would be unable to lift its own weight;

"(2) If one motor stopped the other would make the machine spin around and disaster would surely follow.

"Only three years ago, when the committee of which I was a member offered its assistance to Admiral Fiske to develop the torpedoplane, and experiments were being planned, a man who was contributing editor to a technical publication, wrote several earnest letters to Admiral Fiske, arguing that it was mechanically impossible to construct an aeroplane large enough to carry a torpedo. This man did not know that aeroplanes larger than required were actually flying daily overseas and wasted the valuable time of authorities with his childish arguments. A few months later this man became an Army officer and one day was assigned to guard the large Caproni which had landed at the Polo Field, Washington, D. C. Admiral Fiske went to see the aeroplane—and it became the duty of this Army officer to escort Admiral Fiske while he was inspecting the aeroplane which he had pronounced impossible!

"These petty theoretical notions delayed the construction of large aeroplanes in the United States so that it was not until the close of the war that orders were placed for large planes in England, France and Italy. Even after the Handley Pages and the Capronis had demonstrated their potentiality, fastidious theorists still denied their practicability.

Twenty-five Miles On a Gallon of Gasoline Possible With New Improvements

"I anticipate that this contest will demonstrate that aeroplanes built in accordance with the latest discoveries and improvements will be so efficient as to make it possible to cover twenty-five miles on one gallon of gasoline and that a plane of the size of the one used by Alcock and Brown in crossing the Atlantic from Newfoundland to Ireland can easily fly twice that distance, and to fly from New York to San Francisco without stop, with a load of mail.

"The improvements in wing construction alone—adopting the improved wing construction of Capt. James V. Martin, Handley Page or the new 'Alula' wing evolved by British engineers—more than double the present carrying efficiency of aeroplanes. Our records show that Capt. James V. Martin, the veteran American aeronautic engineer and inventor, presented us with plans for a transatlantic flyer in 1917, which was to have wings lifting over twenty pounds per square foot at normal speed. At that time the most efficient wing was only granted a lift of eight pounds per square foot, therefore we questioned him and went over the reports of official aerodynamic tests.

"Several prominent men interested in national defense were ready to place orders for a number of large aeroplanes in connection with the organization of aerial reserve units, and we went over all the available plans for large planes and soon were convinced of the practicability of constructing aeroplanes capable of being flown across the Atlantic. A number of leading U. S. Navy and Army pilots, as well as civilian pilots, offered to fly the planes across the Atlantic, and the plans were ready when the United States entered into the world war. Then offers were made to the Navy Department first, then to the War Department, to present them with the planes, free of charge and to pay the cost of operating them for the government, if desired. In two cases patriotic people offered to pay for building the planes and all the expenses of equipping and operating an air station, as Army and Navy had only two permanent air stations at that time. But the offers were declined.

The Martin, Handley Page and "Alula" High Lift Wings

"Of course, I was not at liberty to tell about the remarkable developments that had taken place in the construction of aeroplanes, but this knowledge proved of great value in giving advice to government authorities and Congressional committees in evolving a substantial aircraft program—and in working out forecasts of aeronautic developments, and in writing the Textbook of Naval Aeronautics, the Textbook of Military Aeronautics and the Textbook of Applied Aeronautic Engineering. I concentrated on data and arguments in favor of large aeroplanes, so as to create the widest possible interest in large aeroplanes.

"During the past year the Handley Page and 'Alula' wings have been announced, both having revolutionary high lifts.

"Besides evolving wings of greater efficiency, a number of other equally important and revolutionary improvements have been made which will be made public later. As pointed out in the Textbook of Applied Aeronautic Engineering, which gives the photographs and the designs and data regarding the world's large aeroplanes, in the past from forty to sixty per cent of the lifting capacity has been required to lift the aeroplane itself; but with improved methods of construction the weight of the aeroplane is cut down to half without sacrificing strength.

Aerial Transport Rates With Large Planes Will Equal Railroad and Steamship Rates

"We are justified in believing that an aeroplane constructed in accordance with the latest discoveries and improvements, carrying from twenty tons of useful load and up, can be operated so economically as to make it possible to equal railroad and first-class steamship transportation rates in the transportation of passengers and express matter, at the same time affording a quicker service.

Status of Present Day Aeroplanes

"Aeroplanes have reached speeds as great as 200 miles an hour, have carried loads ranging up to four tons and have reached altitudes up to 36,000 feet, which is higher than the world's highest mountains, and more than fifty passengers have been carried in one flight. In fact, the accomplishments of aeroplanes have exceeded the expectations even of those to whom the subject of aviation has been a life study.

"Notwithstanding these accomplishments, those who can see the future of aeronautics from a broad standpoint realize that in so far as the construction of an aeroplane is concerned, aeronautics is in exactly the same position today as shipbuilding would be if shipbuilders had only reached the stage of building racing boats and small yachts. We still have to produce the large air liner, the economical aeroplane capable of carrying tens of tons of useful load at express rates, and the low priced small aeroplane, which will be the equivalent of the motorboat, or the Ford automobile in the air. These still are to be produced. When they are produced aeronautics will be as great an industry as the automobile and shipbuilding industries are today.

"We are just beginning to build low priced aeroplanes which will represent in aeronautics the equivalent of the motor boat. There are already small aeroplanes with a wing spread of 18 to 20 feet, capable of going at the speed of 60 to 80 miles per hour, promising to go from 15 to 30 miles to the gallon of gasoline. These small planes represent in aeronautics what the motor boat represents in the marine field or what the Ford and Dodge cars represent in automobiles and will be powerful factors in popularizing aviation.

"But as regards large aeroplanes, we have only begun to build the equivalent of small yachts, and to go beyond this brings up a large number of problems.

"The NC-1 Flying Boat had a wing spread of 126 feet, the chord and gap of the planes are 12 feet. The machine was driven by three Liberty engines of 350 h.p. each. A speed of 80 miles was made, and the machine has ascended to a height of 2,000 feet in ten minutes. Fully loaded, this machine weighed 22,000 pounds. It carried a useful load amounting to approximately 4½ tons.

"Constructed today, with the improvements possible due to the progress made in aeronautic engineering in the past two years, the NC-1 would give one hundred per cent greater efficiency.

"But the real commercial efficiency and revolutionary value to the world will come with aeroplanes carrying from seventy-five to one hundred tons of useful load. These will be regular air liners, capable of being operated in intercontinental and transcontinental daily commercial transportation service at rates comparing favorably with the total cost of first-class railroad and steamship travel over a given distance. In other words, if the transatlantic trip can be made in less than two days, there is considerable saving besides the actual price of the tickets and Pullman accommodations.

"True, it seems but yesterday that those few of us who believed in the possibilities of human flight spent our time discussing the possibility of copying birds' wings and learning the secret of flight from the birds, those whose flight seemed easiest to study and understand, and their wings seemed easiest to reproduce in wood and canvas.

"We felt heartened when Langley, Chanute, the Wrights and other pioneers tested their models and their gliders, and demonstrated the basic theories which later were the principal factors in achieving dynamic flight; likewise we felt heartened when H. G. Wells and Kipling and others expressed their belief that Man would fly some day. When Wells, in his book, 'Anticipations,' in 1902, stated his belief that dynamic flight would become an accomplished fact fifty years hence, the World smiled incredulously, but some of us fully believed that it would happen. We were dreamers with Wells—but very conservative dreamers, as time has proven!

"In fact, as I look back at my own personal written phophecies and review my experiences for the past ten years, I find that I was usually considered very optimistic in my phophecies early each year—but time and events would prove my prophecy very conservative before the end of the year!

One Hundred Ton Aeroplanes Within Two Years

"Within two years there can and will, no doubt, be put in service aeroplanes capable of carrying from fifty to one hundred tons of useful load and dirigibles and aeroplanes capable of carrying tons of mail and express and passengers from New York to London in thirty hours. We have the engineers to design and build the aircraft and the world needs faster transportation and is ready to patronize aerial transportation.

(*Continued on page* 121)

THE NEWS OF THE WEEK

Air Travel De Luxe by New Mail Fliers

Chicago.—Passengers as well as mail will be carried in palatial air liners on three air mail routes, contracts for which were awarded the Lawson Air Line Company of Chicago by the Postoffice Department.

The first service will start between Pittsburgh and Indianapolis, by way of Columbus and Cincinnati, in November.

The air liners, with wicker chairs enclosed in glass windows and streamline bodies, are now being built for the new service, officials of the company announced.

The contracts will cost $685,000 a year. They call for aerial mail service from Pittsburgh to St. Louis by way of Columbus, Cincinnati and Indianapolis, at a cost of $147,000 a year; between New York and Chicago, via Harrisburg, Pittsburgh and Fort Wayne, Ind., for $238,000 a year, and for service between New York and Atlanta, via Washington, Raleigh, N. C., and Columbia, S. C., at a cost of $300,000.

The government contract provides that each plane must carry 1,500 pounds of mail per trip. In addition the company is providing accommodations for sixteen passengers, the latter end of the business being a private venture. Three hundred and six round trips are to be made yearly on each route.

Service on the New York-Chicago and New York-Atlanta routes probably will not be inaugurated until next spring. Connecting airlines between Cleveland and Detroit and Chicago and Indianapolis probably will be opened later, the company announced, and bids made for the mail-carrying contract.

A night service on the lines will be started and standard berths will be part of the equipment, Floyd K. Smith, assistant general manager of the company, said. Shower baths and all modern conveniences will be installed, he added.

Half-hour stops will be made at each of the controls and the company will open restaurants on the air fields for the service of the passengers.

To Pick Three Cup Fliers

Paris, Sept. 21.—A committee of the Aero Club of America, comprising Colonel Jefferson Thompson, Sidney B. Veit, Cortlandt F. Bishop and Captain V. E. Bertrand, was appointed to select the three American representatives to compete in the James Gordon Bennett Air Cup Race to be held September 28th. Six American machines are now on the ground.

It has not yet been decided whether elimination trials shall be held or the three contestants picked directly by the committee. The committee's decision, in any case, will be final.

Italian Machines Entered for Gordon Bennett Race

Paris.—An element of mystery surrounds the Italian entries for the James Gordon Bennett race to be held September 26. The entries came unexpectedly, without any previous intimation that the Italians intended to have representatives in the race. The Aero Club of France was informed that the Italians would start a Balilla machine and also an "S. V. A. Special." The names of the pilots were not given and nothing is known as to the whereabouts of the machines, which will be the same the Italians raced in the Antwerp Olympics.

A Martynside machine, with Capt. F. P. Raynhan as pilot, reached Villa Coublay yesterday, as did also I. R. Tait-Cox in a Nieuport Special of English make. Harry G. Hawker has not yet reached France, and although reports persist that he will enter the race, it is doubtful whether he will start. Thus, there will probably be only two British entries.

The three French favorites, Sadi Lecointe, Capt. de Romanet and Adjutant Jean Casale, have negotiated the cup journey several times, and it is said unofficially that Lecointe reached a speed of close to 300 kilometres.

Massachusetts Association Inspects Forest Patrol

Sixteen members of the Massachusetts State Fire Prevention Association were visitors at March Field, California, recently. Mr. Harris A. Reynolds, secretary of the association, was taken in a DH over parts of the Los Angeles and Cleveland reserves. The party visited many points along the Pacific coast in connection with their inspection of forest patrol work. They were particularly interested in the aerial operations as carried on from this base, and complimented the Air Service for its efficient work in the protection of our national forests.

Campaigns for Sheriff at 2,000 Feet Up in Air

Borough Secretary Joseph Flanagan of Queens, New York, the Democratic candidate for Sheriff of Queens, introduced a novelty in campaigning by going up in an aeroplane with some of his friends and several army officers and distributing campaign documents over the borough.

The start was made from the aviation field at Central Park, L. I. He flew over Flushing, Elmhurst, Long Island City and Jamaica in Queens and then over the Mineola Fair Grounds, where were gathered a large number of the candidates and prominent men, among whom Flanagan dropped his circulars from a height of 2,000 feet. The flight was made in a J.L.6 All-metal monoplane.

John Petrie was the pilot of the aeroplane. Others in the aeroplane were James Fitzgerald, Chife Inspector of the

West Palm Beach, Florida, photographed by Capt. Hugh L. Willoughby

Central Park field; Robert Reilly, a moving picture manager of Long Island City; H. P. Wilson, inspector of aeroplanes in the United States Service; Lieut. Charles V. Bill, U. S. A.; Horace Beatty of Long Island City, and C. B. Kirkham, Chief Engineer of the Larsen Airplane Company.

Aerial Fisheries Patrol in Canada

Arangements have been made with Major McLaurin, commandant of the Jericho Seaplane Station at Vancouver, and the Canada Air Board for the use of one or two of the big flying boats for coast fisheries patrol purposes.

Paris and Strasbourg Joined in Aerial Link

An aerial service between Paris and Strasbourg, to be covered three days each week, was inaugurated September 20th. A service from Strasbourg to Prague, Czecho-Slovakia, will be opened next week and a line from Prague to Warsaw on October 19th.

The latter two lines are dependent, however, upon the attitude of the Germans, over whose territory the aeroplanes must fly.

Air Harbor at Quebec

Captain A. Leroyer, M.C., of the Canada Air Board, has been in Quebec in connection with the harbor for seaplanes at Lampson's Cove on the river front. In an interview with the Quebec Harbor Commission, Captain Leroyer asked that body to assume the license from the Air Board, and the matter is now under consideration. This seaplane harbor will be a station for trans-continental flights and will place Quebec on the all-red air route.

Aero Banquet in Kennett Square

Through the activity of a group of young men of this borough, a movement looking to the establishment of an emergency landing field for aircraft, in the vicinity of Kennett Square, is well on the way, and so officers of the Pennsylvania Aero Club, of Philadelphia, came to town for the purpose of a conference upon the subject. Paul Huyette, vice-president of the Aero Club of Pennsylvania, gave some practical information regarding aircraft and flying. The interest and enthusiasm was thoroughly cordial, and the meeting decided to have, and contracted for, an air photograph of the town. Mr. C. L. Hower, of the Philadelphia Aero Service, is co-operating with the officials in charge of the movement.

THE LOST DIRIGIBLE: By *Ralph Henry Barbour, Author of "For the Freedom of the Seas," "Guarding His Goal," etc.*

"The Lost Dirigible" will reward the reader with the same thrill he felt on reading Mr. Barbour's "Under the Yankee Ensign" and "For the Freedom of the Seas." Boys' interest is said to be particularly centered in aviation at present, and when this subject is coupled, in a book, with Mexico and bandits, the story becomes irresistible to boy readers. The scene is laid in the United States Naval Aviation Base at Camp Stanton, Del Rio, Texas. Jack Sterling, 17, third class electrician, radio, is ordered to Camp Stanton for duty, and finds himself assigned to the scout dirigible F 8, on which he is to act as assistant radio operator under Ensign Hugh Clode. The F 8 receives orders to make a reconnaissance voyage westward over the State of Coahuila, to observe the activities of the insurgent leader, Tito Roza, who has gathered a large force with the rumored intention of invading Texas. Relations between the United States and Mexico are strained and border raids and clashes have become frequent. A cyclone drives the F 8 out over the Gulf and lightening strikes her, tearing off her planes. Helpless, she drifts with the storm all night. At length a landing place is reached in the very heart of Tito Roza's territory, and the aviators descend to make repairs. Here the Mexicans attack them and take all the party prisoners except Jack and Hugh. How the boys save the crippled dirigible and then lead in the rescue of their fellow aviators, rounds out a story of adventure that is hard to surpass.

This book can be purchased at the Aeronautic Library, Inc., 299 Madison Avenue, New York City, N. Y. Price $2.00 postpaid.

Some prominent Ohio supporters of aeronautic progress: 1. Major A. W. Harris, president Cleveland Aviation Club; 2. Rex L. Uden, secretary Associated Aero Clubs of Ohio; 3. Commander P. N. Bellinger; 4. Lt. Col. R. S. Hartz, vice-president Cleveland Aviation Club; 5. Major Richard S. Davis, president Aero Club of Cincinnati; 6. Cadet John M. Renner, treasurer Cincinnati Aero Club; 7. Lieut. Thos. J. Hubert, vice-president Cleveland Aviation Club; 8. Lt. Henry F. Gravenkemper, secretary Aero Club of Cincinnati

The AIRCRAFT TRADE REVIEW

Flies 125 Miles in 64 Minutes

Carrying a crew of four men and a 1,600-pound torpedo, a Martin bombing plane, fitted with torpedo gear, flew from Washington to Yorktown, Pa., a distance of 125 miles, in sixty-four minutes. Naval officers declared they believed the flight established a record for planes of that type.

The flight was made as a test of the Martin plane in conection with its use in the bombing and torpedo practice soon to be conducted, with the old battleship "Indiana" as a target.

Passenger Service from New York to Newport Planned

A daily airline passenger service between New York and this city is a possibility next summer. Major Lorillard Spencer, who has been flying back and forth between Newport and New York all summer, is greatly interested in the proposed new line.

The tentative plan is to have two flying boats, capable of carrying six or more passengers, engaged in the service, one to leave New York in the morning so as to arrive in Newport before lunch, and the other to leave Newport in the afternoon to insure passengers being in New York in time for dinner.

The city officials in Newport will be asked to keep the southern end of the harbor clear of boats and to construct a suitable landing place there.

Aeroplanes Aid Fishermen

As a result of patrols maintained by naval seaplanes, Chesapeake Bay fishermen are making the biggest hauls on record. Reports recently to the Navy Department from the commandant of the naval air station at Hampton Roads said the patrols had proved "indispensable" to the fishing industry of those waters.

Immense schools of fish are spotted almost daily by the seaplanes, it was reported, and fishing fleets are given the location by radio communication or, if within sight, by flag signals.

Detroit to Have Second Landing Field

The city of Detroit, determined to maintain its lead as a progressive areonautical center, intends establishing its second municipal landing field. At the request of the Commissioner of Parks and Boulevards, the commanding officer of Selfridge Field, Captain N. J. Boots, flew over the proposed site and after making an additional ground inspection will recommend its establishment at the next meeting of the city council. The field will only permit one-way landings to be made, but in the event of a strong south wind the other municipal field, located several miles away, will be available. The new field is situated along the Detroit River, very close to the heart of the city, and its water frontage makes it peculiarly adaptable for use by seaplanes. In fact, it is already being used by the United Aerial Express Company as a home base for its seaplane flying between Detroit and Cleveland.

Pacific Airplane & Supply Company Reorganized

The Pacific Airplane & Supply Company of Venice, Cal., has just been taken over by a new group of officers who have been pioneers in the commercial aircraft field on the Pacific Coast.

Emery H. Rogers, President and General Manager, was, during the war, officer in charge of flying at Souther Field, Americus, Georgia. Upon leaving the army he interested Mr. Sydney Chaplin with him, and organized the Syd Chaplin Aircraft Corporation of Los Angeles, of which he was General Manager for a year. Early in February of this year Mr. Rogers severed his connections with the Syd Chaplin Corporation and took over the Pacific Airplane & Supply Company, with J. B. Webster, formerly Sales Manager of the Syd Chaplin Corporation, and W. P. Halliday, formerly in charge of water operations at the Syd Chaplin Corporation. Mr. Rogers, it will be remembered, made the first and only round trip from Los Angeles to San Francisco and return, in one day, in the record time of eight hours and forty-two minutes, demonstrating the practicability of breakfast in Los Angeles, luncheon in San Francisco and dinner in Los Angeles again.

The Chief Engineer and Designer of the Pacific Airplane & Supply Company is Mr. O. W. Timm, who has designed and built thirteen successful types of ships, including the Pacific Hawk, a low-priced, twin-motored, six-passenger plane.

The plant is now turning out the Pacific Standard, motored with the Curtiss OX-5 or the Hall Scott Liberty—6 motors.

Their plant is a modern brick building, with all the latest machinery for the rebuilding and repairing of planes and motors. A big twin Liberty Freighter has been designed and will be placed on the market shortly, which promises a remarkable performance.

Aerial Delivery of Newspapers Successful

An achievement in aerial navigation which speaks well for the Northwest came to an end on Labor Day. Victor Vernon, manager of the Oregon, Washington and Idaho Airplane Company, Portland, Ore., started the delivery of newspapers on June 16, 1920, from Portland to Astoria and Seaside, Ore., a distance of one hundred and ten miles, and during the thirteen and a half weeks, excepting Sundays, a 100 per cent delivery was made.

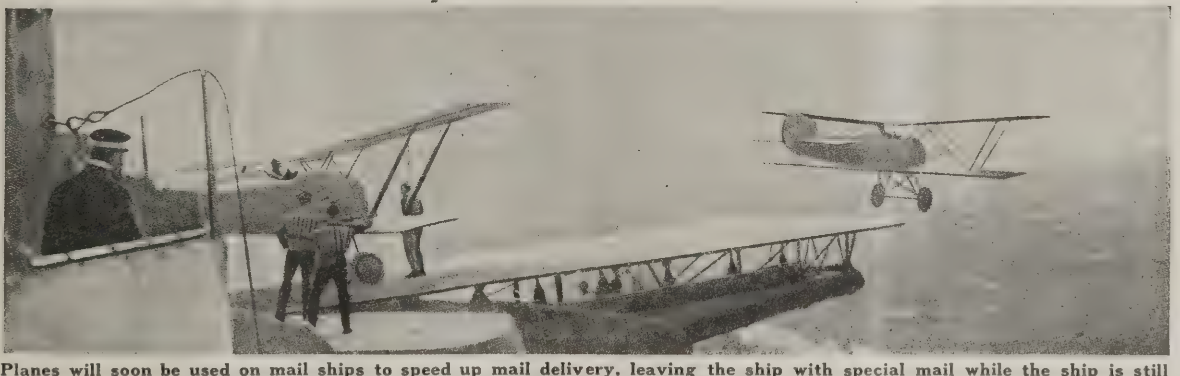
There was much adverse weather during the time, but the pilots got through, which speaks well for the equipment and men. The total poundage often reached over 300 pounds. This work was all done with seaplanes of the Curtiss Seagull and F-Boat type.

Along with this nearly one hundred passengers were carried to and from these points without a single scratch to plane or passenger.

The equipment of the company totals thirty planes, consisting of Standards, JN-4 Ds, Orioles, Seagulls and F Boats. The field equipment consists of eight land hangars and a boat hangar, housing six boats with a 60-foot skidway to the river, which takes care of a thirty-foot rise and fall of water; a shop fully equipped for assembling planes; motor room and engine test block, dope room and a big supply room of spares and parts.

The company's planes have carried over four thousand passengers in the last ten months and have not had one accident.

The personnel consists of Victor Vernon, manager; Howard C. Charlton, assistant manager; seven pilots, ten mechanics and an office force of three.



Planes will soon be used on mail ships to speed up mail delivery, leaving the ship with special mail while the ship is still several hundred miles from port

Albert S. Burleson, Postmaster General
Otto Praeger, Second Assistant Postmaster General
Leon B. Lent, General Superintendent, Air Mail Service

J. Clark Edgerton, Chief of Radio
Charles I. Stanton, Chief of Maintenance
George L. Conner, Chief Clerk

D. V. Colyer, Chief of Flying

PILOTS

H. H. Rowe
J. P. Murray
C. V. Pickup
C. A. Braukman
S. S. Boggs
F. R. Yager
J. P. Woodward
B. M. Hefron
J. L. Mortensen
G. C. Black
Eric Springer
W. H. Jones
Ralph Watson
J. W. Sharpnack
J. L. Eaton
E. E. Mouton
W. L. Morgan
W. H. Williams
R. S. Little
K. M. Stewart
W. R. Holcomb
W. M. Barr
E. R. Vanatta
W. D. Williams
H. A. Chandler

P. W. Smith, Superintendent, New York-Chicago Division
E. W. Majors, Superintendent, Chicago-Omaha Division
A. R. Dunphy, Superintendent, Omaha-Salt Lake Division
John A. Jordan, Superintendent, Salt Lake-San Francisco Division
Carl Egge, Superintendent, Twin City-St. Louis Division
J. E. Whitbeck, Superintendent, New York-Washington Division
R. F. Holderman, Manager, Hazelhurst Field, L. I.
M. J. Kelly, Manager, Bellefonte, Pa.
H. M. Guerney, Manager, Cleveland, Ohio
S. M. Moore, Jr., Manager, Chicago, Ill.
H. S. Long, Manager, Iowa City, Iowa
H. L. Hartung, Manager, Cheyenne, Wyo.
W. I. Votaw, Manager, Omaha, Nebr.
G. R. Houston, Manager, Salt Lake City
O. A. Tomlinson, Manager, Reno, Nev.
Vern Hinkley, Manager, San Francisco
W. G. Witzel, Manager, St. Louis, Mo.
F. A. O'Leary, Manager, Washington, D. C.
C. A. Parker, Superintendent of Repairs, Bustleton, Pa.
E. W. Majors, Superintendent of Repairs, Chicago, Ill.

PILOTS

E. M. Allison
E. C. Davis
E. M. Haight
W. L. Carroll
Rufus Riddlesbarger
A. L. Jewett
L. H. Garrison
R. A. Reed
H. C. Brown
R. G. Jones
E. F. Baskey
Bryan McMullen
H. W. Cook
I. S. Amberg
E. Hamilton Lee
Robert H. Ellis
Randolph G. Page
Elmer G. Leonhardt
Frederick A. Robinson
Walter J. Smith
Wesley L. Smith
James T. Christensen
Harry Huking
Clarence C. Lange
William C. Hopson

Air Mail From Far North

The first mail ever brought out from the James Bay District in a seaplane was received in Montreal on August 23rd by Revillon Freres, McGill Street. The first seaplane to ever venture into that unknown and more or less unexplored country left from about fifty miles west of Cochrane, on August 17th, and after two hours and fifteen minutes in the air made a safe landing at Moose Factory, a point on James Bay, which is about two hundred miles distant from the starting place. The return trip was made on August 18th, when the mail was brought out to be posted in Cochrane. The pilot was W. R. Maxwell and the engineer G. A. Dean.

Air Mail in New South Wales

An aerial mail service, connecting Lismore, Casino and Tenterfield in New South Wales, has been definitely established. The initial flight required 75 minutes, including a landing at Casino, where mail was delivered and received. The distance by road is about 100 miles of one of the most beautiful and wealthiest sections of the entire Australian continent.

Send Mail by Air to Avoid Raids

Dublin.—To check the constant attacks on government mails throughout the country, an aerial mail service has been inaugurated for the conveyance of mail other points where police and military are for Dungarvan, County Waterford, and quartered.

UNITED STATES POST OFFICE DEPARTMENT

NEW YORK-CLEVELAND DIVISION—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, June, 1920

Aeroplane No.	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST Gallon of Gasoline	Total Time Run hr. min.	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
34	$158.56	$22.56	$72.26	$38.37	$15.58	$50.99	$226.93	$159.63	$255.48	$56.92*	$70.48	$1,127.76	565	18 20	1,425	2.5	$61.51	$0.79
38	....	....	72.26	38.37	15.58	50.99	....	120.00	545.15	72.50	70.48	985.33	......	....	....	....	....	.....
39-A	19.04	1.08	72.26	38.38	15.58	50.99	....	64.71	36.75	75.00	70.48	444.27	68	....	....	....	....	.....
42	208.32	18.40	72.26	38.38	15.58	50.99	243.85	131.34	65.00	68.54*	70.48	983.14	737	19 42	1,731	2.3	49.90	.57
48	121.80	9.48	72.26	38.38	15.58	50.99	57.97	605.07	4,627.12	41.50*	70.48	5,710.63	367	4 41	415	1.1	1,219.35	13.76
60	35.84	5.41	72.26	38.38	15.58	50.99	61.27	94.81	39.33	50.00	70.48	534.35	128	4 57	365	2.9	107.95	1.46
63	....	....	72.26	38.38	15.58	50.99	....	237.50	283.48	50.00	70.48	818.67	......	....	....	....	....	.....
64	19.60	1.75	72.26	38.38	15.58	50.99	21.66	15.40	....	13.52*	70.48	319.62	70	1 45	200	2.9	182.64	1.60
66	....	....	72.26	38.38	15.58	50.99	....	141.00	125.60	50.00	70.48	564.29	......	....	....	....	....	.....
80	517.99	43.40	72.26	38.38	15.58	50.99	792.19	262.49	225.46	50.00	70.48	2,139.22	1,844	64 ..	5,490	2.9	33.42	.39
85	111.82	12.21	72.26	38.38	15.59	50.99	151.01	227.83	241.83	50.00	70.48	1,042.40	398	12 12	1,100	2.8	85.44	.95
89	485.75	51.79	72.26	38.38	15.59	50.99	613.74	365.99	422.03	47.88*	70.48	2,234.88	728	49 35	4,390	6.0	45.07	.51
91	....	....	72.26	38.38	15.59	50.99	....	105.00	31.72	50.00	70.49	434.43	......	....	....	....	....	.....
92	56.56	10.88	72.26	38.38	15.59	50.99	96.02	378.73	1,603.88	50.00	70.49	2,443.78	202	7 48	715	3.5	313.30	3.42
99	43.85	6.95	72.26	38.38	15.59	50.99	86.03	310.46	3,958.00	50.00	70.49	4,703.00	155	6 57	540	3.5	676.69	8.70
107	213.05	23.66	72.26	38.38	15.59	50.99	296.45	158.47	10.58	50.00	70.49	999.92	759	23 57	2,250	3.0	41.75	.44
110	....	....	72.26	38.38	15.59	50.99	....	64.30	1,077.18	14.30*	70.49	1,403.49	......	....	....	....	....	.....
111	34.49	1.05	72.26	38.38	15.59	50.99	37.34	19.16	10.25	7.86*	70.49	357.86	123	3 01	200	1.6	118.63	1.79
44304	.84	.63	72.26	38.38	15.59	51.00	....	40.42	511.78	35.00	70.49	836.39	3	....	....	....	....	.....
Total	$2,027.51	$209.25	$1,372.94	$729.20	$296.11	$968.82	$2,684.46	$3,502.31	$14,070.62	$883.02	$1,339.19	$28,083.43	6,147	216 55	18,821	3.1	$129.46	$1.4

Cost per mile, overhead, $0.25; cost per mile, flying, $0.26; cost per mile, maintenance, $0.98.
Cost of rebuilding one De Haviland plane outside of our service, $1,560.86.
Cost of rebuilding one Curtiss R4 plane outside of our service, $1,768.90.
Planes Nos. 34 to 48, inclusive, except 39-A, Curtiss R4, equipped with Liberty 12 motors.
Plane No. 39-A, Curtiss HA, equipped with Liberty 12 motor.
Planes Nos. 60 to 110, inclusive, De Havilands, equipped with Liberty 12 motors.
Plane No. 111, Twin De Haviland, equipped with two Liberty 6 motors.
Plane No. 44303, Curtiss JN4D, equipped with Curtiss OX5 motor.
*Indicates that plane appears on another report.

OTTO PRAEGER, Second Assistant Postmaster Genera.

THE PROBLEM OF THE TURBO-COMPRESSOR

By René Devillers, Ingénieur de L'Ecole Supérieure D'Aéronautique

Translated from the French by Paris Office, N. A. C. A.

IN terminating the study of the adaptation of the engine to the aeroplane, we will examine the problem of the turbo-compressor, the first realization of which dates from the war; this will form an addition to the indications already given on supercharging at various altitudes.

We will begin by giving the experimental results at present determined, relative to the influence on the power of a back pressure at the exhaust, greater or less than the pressure in the admission manifold.

This subject is of great importance for the application of the turbo-compressor worked by the exhaust gases. As a matter of fact, a compressor increasing the pressure in the admission manifold may be controlled by the engine shaft by means of multiplication gear or by a turbine operated by the exhaust gas. Assuming that the increase of pressure in the admission manifold is the same in both cases, the pressure in the exhaust manifold would be greater in the case in which the compressor is worked by the exhaust gas and there would result a certain reduction of engine power which we must be able to calculate. On the other hand, if the compressor is controlled by the engine shaft, a certain fraction of the excess power supplied is utilized for the rotation of the compressor. In order to compare the two systems, it is therefore necessary to determine the value of the reduction of power due to back pressure when the turbine is employed.

The Influence of Back Pressure at the Exhaust on the Power

A series of tests has been made with a 220 h.p. engine, 1,600 r.p.m. water circulation, 12 cylinders 114 x 139, volumetric ratio 4.7. At the outlet of the exhaust pipe this engine was fitted with a throttle valve, so that the positive back pressure could be regulated as desired. The negative back pressures were obtained by connecting the exhaust with a depression chamber. In these tests the air admitted was at the temperature and pressure of the atmosphere, the carburetor inlets opening direct into the surrounding air.

The general conclusions drawn from those tests were as follows:

1st. If the pressure in the inlet manifold be raised above the pressure in the exhaust manifold, the effect is an increase of power in direct proportion to the excess of inlet pressure over exhaust pressure. It is practically independent of the speed of the engine.

2nd. If the pressure in the inlet manifold be maintained at the normal atmospheric pressure on the ground, the exhaust pressure being below it, as in the case of the compressor worked by the crankshaft, the percentage of increase of power with respect to that on the ground is given pretty accurately by 18p, p being the excess of pressure in the inlet manifold over the pressure in the exhaust manifold, expressed in kilograms per square centimeter. It should be remarked that the results vary slightly according to the type of engine and even with engines theoretically identical. The reason is probably to be found in differences in the regulation of the valve gear.

3rd. A positive back pressure at the exhaust reduces power more than a corresponding negative back pressure increases it. As the back pressure increases, the effect becomes rapidly more marked. The mean results of tests made on two engines of the same type, gave in percentage a loss of power equal to $18p + 24p^2$, p being the excess of pressure in the exhaust over that in the admission, expressed in kilograms per square centimeter.

Tests on engines of other types have shown that results differ notably with different engines.

The very marked effect of a positive back pressure, even a comparatively small one, probably arises from the fact that, when the exhaust pressure is appreciably greater than the admission pressure, non-escaped exhaust gas remains under pressure in the cylinder. When the admission valve opens, this gas deteriorates the mixture in the admission manifold. In the extreme case in which the carburetor might be affected by such a counter-stroke, the effect might be to expel the gasoline.

The effect produced depends partly on the compression ratio and on valve adjustment, but more especially on the shape of the inlet manifold.

4th. Increase of pressure in the inlet manifold or of negative back pressure in the exhaust, improves the volumetric efficiency by reducing the proportion of exhaust gas remaining in the cylinder. The consumption of gasoline per h.p./hour may be slightly reduced in consequence.

Thus, for a normal consumption of 230 grammes, we have noted a specific consumption of 220 grammes with a back pressure of —O kg. 600.

A positive back pressure has the contrary effect. A back pressure of +0.500 kg. raised the specific consumption to 250 grs.

5th. Increase of pressure in the admission manifold increase thermic efficiency and reduces the proportion of heat carried off by the water circulation. This point is of great interest in designing radiators for supercharged engines.

We may admit that the total amount of heat to be evacuated by the radiator is constant for all negative back pressures, the ratio of this quantity to the calorific equivalent of the power diminishing as the negative back pressure increases.

Fig. 393 (p. 875 of original text) gives the results of tests made on two engines of the same type.

Application.—Let us consider an engine fitted with a compressor which, at all altitudes, maintains the pressure in the admission manifold equal to the normal pressure on the ground level. With the foregoing figures, the power developed will be greater than the power on the ground level by 18p % of this power, p being the difference between the pressure in the admission and exhaust manifolds, expressed in kilograms per square centimeter.

The Rateau device, presenting a turbine driven by the exhaust gases, provides for the maintenance of pressure in the admission and exhaust manifolds at the pressure on the ground level, thus keeping up the power of the engine. In this case, the power developed by the engine at a given altitude will be less by 18p % of its value than the power which would be developed at the same altitude if the engine were fitted with a compressor operated by multiplication gear.

We will consider the 220 HP engine used in the tests previously mentioned, and the altitude of 4,000 meters for which the relative atmospheric pressure is 0.61. With the turbine worked by exhaust gas, the engine would give a horsepower of 220, equal to that on the ground level. With the compressor worked by multiplication gear, which also maintains the intake pressure at the level of the pressure on the ground, we shall have a negative back pressure at the exhaust $p = 1 - 0.61 = 3.09$, when a gain of power of $18 \times 0.39 = 7$ % of the power on the ground level, that is, $0.07 \times 220 = 15$ horsepower. The power developed would thus be 235 HP instead of 220 as in the first case. To obtain the effectiv power, we must deduct that required for the control of the compressor, that is, 14 horsepower according to measurements made on the bench.

The available power is thus the same in both cases and no reason indicates a priori that one solution is better than the other.

The Problem of the Turbo-Compressor.—The object of the Rateau turbo-compressor, realized during the war, is to re-establish in the carburetor, up to an altitude of 5,000 meters, the atmospheric pressure on the ground level, the exhaust gases being evacuated into a chamber in which the pressure is practically the same as on the ground level. The conditions of flight near the ground will thus be re-established up to 5,000 meters.

We will call p_0 the atmospheric pressure on the ground level, and p_z the atmospheric pressure at the altitude Z. The exhaust gas escaping into a chamber in which the pressure is the same as on the ground level, the remaining calories are utilized for turning a single-rotor, axial flow turbine, the exhaust gas expanding in this driving turbine from the pressure p_0 to the pressure p_z.

The turbine is coupled directly to a centrifugal compressor which compresses the air charging the carburetor, making it pass from the surrounding pressure p_z to the atmospheric pressure on the ground level, p_0.

In short, the energy corresponding to the expansion of the exhaust gas from p_0 to p_z through the driving turbine, is utilized in a centrifugal compressor to make the inlet air pass from a pressure of p_z to a pressure p_0.

The problem being thus stated, it remains to be seen whether the energy which can be collected by the turbine is sufficient to obtain the integral compression of the air admitted to the carburetor.

Expansion of the Exhaust Gases Through a Converging Nozzle

We would recall the principles relating to the flow of gas through a nozzle. The flow of gas through a non-diverging nozzle depends only, outside of the coefficient of contraction, on the ratio p/P of the leeward pressure p to the windward pressure P.

1st. $p/P > 0.52$.

If the leeward pressure p is greater than 0.52 P, the rate of flow depends on the ratio of the pressures and increases as this ratio decreases. The pressure of gas at the outlet of the nozzle is equal to the leeward pressure.

2nd. $p/P = 0.52$.

If the leeward pressure p is equal to 0.52 P, the rate of flow reaches its maximum value at the velocity of sound in the gas considered for the pressure 0.52 P. The pressure at the outlet is equal to the leeward pressure.

In the two cases just considered, the gas may expand completely in a converging nozzle.

3rd. $p/P < 0.52$.

If the leeward pressure p is less than 0.52 P, the expansion cannot descend lower than the limit value 0.52 P. The pressure of gas at the neck is greater than the leeward pressure p and is equal to 0.52 P. At its outflow, the fluid then penetrates into a equal to 0.52 P. At its outflow, the fluid penetrates into a medium of which the pressure is less than its own pressure 0.52 p.

There results a sudden expansion and the stream of gas issues making a loud noise.

The rate of flow is equal to the velocity of sound in the fluid, and the output depends entirely on the windward pressure P.

In order that there may be complete expansion in this case, the nozzle must be first converging, then diverging, and the speed at the outlet may then reach considerable values.

Application to the Turbo-Compressor.—The diffuser of the Rateau turbine is formed of converging nozzles; the above considerations may, therefore, be applied to it.

The ratio p_z/p_0 is practically equal to 0.52 at an altitude of 5,000 meters. Under these conditions, assuming that windward pressure must remain constant and equal to the atmospheric pressure p_0 on the ground level, there will be two cases of functioning to consider.

1st. *From 0 to 5,000 Meters:* $p/P = p_z/p_0 > 0.52$. The exhaust gases expand completely through the diffuser. The speed and output of gas, as well as the efficiency of the turbine, increase with altitude.

2nd. *Above 5,000 Meters:* $p/P = p_z/p_0 < 0.52$. On leaving the diffuser the exhaust gas is expanded only up to a pressure of 0.52P. Complete expansion only takes place after the passage of the fine at the turbine exhaust valve.

This part of the expansion is lost, efficiency is lowered. In this case we shall either take a windward pressure equal to p_0, and, consequently, incomplete expansion, or we shall be satisfied with a windward pressure $P = \frac{p_z}{0.52}$ in order to keen complete expansion. In any case, the power supplied by the engine will be reduced at altitudes above 5,000 meters.

Conclusion.—With the single-rotor turbine and converging nozzle the exhaust gas can be completely utilized at ground level pressure only up to an altitude of 5,000 meters.

For higher altitude, a converging-diverging nozzle must be used, involving either turbines of greater run speeds or the adoption of a multiple rotor turbine.

Estimation of Recoverable Energy in Exhaust Gases.—We will take the case of complete expansion when $p_z/p_0 = 0.52$, that is, at the altitude of 5,000 meters, and will estimate the available energy corresponding to this expansion for 1 kilogram of gas.

We will call:

T_1 the Absolute Temperature of the Gas in Front of Nozzle, that is, the temperature in the exhaust manifold. From measurements taken direct, we may admit a temperature of 700° C, whence $T_1 = 973$.

T_2, The Absolute Temperature to Rear of Nozzle.

γ, *Ratio of Specific Heats;* as the mean value for expansion we will adopt the figure 1.293.

By the adiabatic law we have:

$$(1) \qquad \frac{T_2}{T_1} = \left(\frac{p_z}{p_0}\right)^{\frac{\gamma-1}{\gamma}} = 0.52^{0.226} = 0.863$$

From this we deduce $T_2 = 840$, whence a fall in temperature $T_1 - T_2 = 133°$ C.

The kinetic energy brought to the rotor by the gas after expansion in the nozzle is $\frac{V^2}{2g}$, V being the velocity of the gas. If C is the specific heat of the gas at constant pressure, we know, by formula (44) of Chapter II on Thermodynamics, that this available energy corresponding to the adiabatic expansion considered, is expressed in calories.

$$(2) \qquad Q = C(T_1 - T_2).$$

We will take for C the value of the specific heat of the exhaust gas at 600° C, that is, $C = 0.3075$, whence:

$$(3) \qquad Q = 0.3075 \times 133 = 41 \text{ calories}$$

Admitting a loss of 5%, there remains an energy of 0.95 x 41 = 39 calories or 425 x 39 = 16,575 kilogrammeters.

Consequently, an output of 1 kilogram of gas per second would give rise to a power of $\frac{16.575}{75} = 221$ horsepower

If we now take P_t as the efficiency of the turbine, the energy available on the shaft for actuating the compressor will be, in kilogrammeters:

$$(4) \qquad E = 16{,}575\, P_t.$$

The fall in calories being 39, the rate of flow of the gas at the outlet of the nozzle will be given by the formula:

$$(5) \qquad x^2 = 2g \times 425 \times 39$$

whence

$$(6) \qquad x = 91.3 \sqrt{39} = 570 \text{ meters per second.}$$

Counting on a loss of speed of about 2% by friction, we finally obtain a speed of 558 meters per second.

The Compression Stress of the Air Admitted to the Carburetor

We know that 15 grammes of air are required for consuming 1 gramme of gasoline. In order to obtain 1 kilogram of exhaust gas we must therefore have $\frac{15}{16} = 0.940$ kgs. of air.

Let us assume a leakage of 10% in the pipes. For 1 kilogram of exhaust gas, we must thus compress 1.034 kgs. of air.

The compression, assumed to be adiabatic, is effected by means of a centrifugal fan.

The initial absolute pressure and temperature of the air are those of the atmosphere, that is, P_z and T_z; the final pressure and temperature are P_o and T_o. P_o should be practically equal to the atmospheric pressure on the ground level.

We will take $\gamma = 1.4$ as ratio of the specific heats C/c. We shall have:

$$(7) \qquad \frac{T_o}{T_z} = \left(\frac{P_o}{P_z}\right)^{\frac{\gamma-1}{\gamma}} = \left(\frac{P_o}{P_z}\right)^{0.29}$$

For the altitude of 5,000 meters previously considered, we may admit a surrounding temperature of —13° whence

$$T_z = 273 - 13 = 260.$$

Then by substituting $\frac{1}{0.52}$ for $\frac{P_o}{P_z}$ we have:

$$(8) \qquad T_o = 1.21\ T_z = 315$$

that is, a temperature of 12° C. We thus obtain an increase of temperature:

$$(9) \qquad T_o - T_z = 55°$$

Let us now take as a basis 1 kilogram of air. The kinetic energy $\frac{x^2}{2g}$ of the air at the outlet of the centrifugal fan is transformed into pressure. By equation (43) of Chapter II on Thermodynamics, the evolution being assumed adiabatic, the energy corresponding to this kinetic energy is, in calories:

$$(10) \qquad Q^1 = C(T_o - T_z)$$

$C = 0.24$ being the specific heat of the air at constant pressure.

Q′ represents the compression work of the fan; it is, with the figures assumed, $0.24 \times 55 = 13.2$ calories, that is, $425 \times 13.2 = 5{,}610$ kilogrammeters.

But, as the weight of the air to be considered per kilogram of exhaust gas is actually 1.034 kg., we shall have to consider the stress:

$$(11) \qquad E' = 1.034 \times 5{,}610 : 5{,}800 \text{ kilogrammeters.}$$

With an output per second of kilogram of exhaust gas giving 221 horsepower, the power utilized for compressing the equivalent weight of the air admitted would be $\frac{5.800}{75} =$ 77.4 h.p.

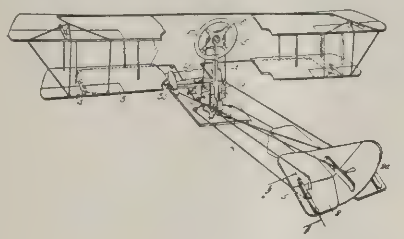
If ρ_v stands for the efficiency of the fan, the energy required for its rotation will be, in kilogrammeters:

$$(12) \qquad E = \frac{5{,}800}{\rho_v}$$

(*To be continued*)

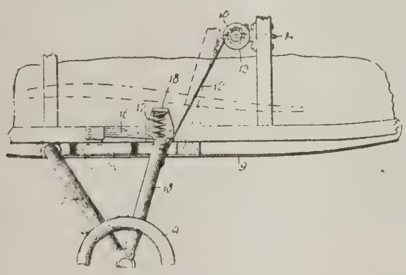
RECENT AERO PATENTS

1,316,079. AUTOMATIC CONTROL AND AVIATOR'S COMFORT DEVICE. ANTHONY BORSELLA, New York, N. Y. Filed Aug. 8, 1918. Serial No. 248,940. 9 Claims. (Cl. 244—29.)



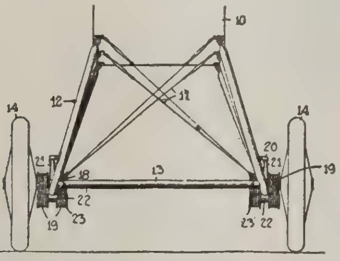
1. The combination with an aeroplane provided with a steering bar connected with a rudder of a plurality of spring members rigidly secured to the stationary part of the aeroplane and slidingly connected with the ends of said bar for resiliently holding the bar in a given position and the rudder in a neutral position.

1,306,768. AIRCRAFT RUNNING AND ALIGHTING DEVICE. JAMES V. MARTIN, Detroit, Mich. Filed June 8, 1916. Serial No. 102,576. Renewed Oct. 3, 1917. Serial No. 194,595. 19 Claims. (Cl. 244—2.)



17. In an aeroplane, a retractable chassis, a fuselage having a sheathing open to receive said chassis, and means for closing said sheathing operated by a movement of said chassis.

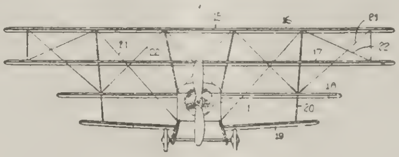
1,306,765. LANDING-GEAR FOR AIRCRAFT. HENRY KLECKLER, Buffalo, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, a Corporation of New York. Filed Nov. 16, 1917. Serial No. 202,402. 5 Claims. (Cl. 244—2.)



1. In a landing gear for aircraft including a substantially V-shaped strut inclined to the vertical and extended straight away from the body of the craft without a bend in the strut, an axle, an axle guide mounted at the foot of the strut, the plane of the axle guide and plane of the strut intersecting, separate groups of shock absorber elastics mounted at opposite sides of the V-strut and at opposite sides of the axle guide, the separate groups of elastics acting independently, a support for the elastics carried by the V-strut and extended beneath and across its bight portion, the elastics being laced for contact with both the support and the axle, and means on the axle and on the support for preventing displacement of the elastics.

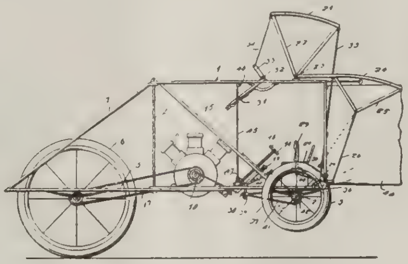
1,306,750. AEROPLANE-WING TRUSS. GLENN H. CURTISS, Garden City, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, Buffalo, N. Y., a Corporation of New York. Filed March 13, 1918. Serial No. 222,213. 2 Claims. (Cl. 244—14.)

1. In an aeroplane, the combination with the fuselage and landing gear, of a wing truss, including superposed wings arranged respectively above and below the plane of the fuselage, the lowermost wings being attached to the landing gear, wing posts, and lift and drop wires cross arranged, the lift wires at one end being fastened to the fuselage adjacent the points of attachment of the landing gear rather than at the points of attachment of the adjacent wings.



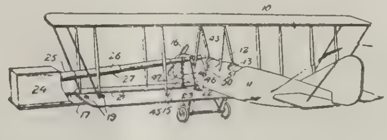
2. An aeroplane wing truss including cross arranged lift and drop wires, the outer ends of the outermost cross arranged wires being fastened to wings in closer proximity to each other than the wings, to which the inner ends of said wires are fastened and the outer ends of the cross arranged wires next inwardly removed from the outermost being fastened to the same wings as the inner ends of the outermost wires are fastened, said last mentioned cross arranged wires being fastened at their inner ends at points even more distantly removed from each other than the distance between the wings to which the outer ends of said wires are fastened.

1,307,097. COMBINED MOTORCYCLE AND AEROPLANE. CHARLES D. HUNTER, Newport News, Va. Filed Oct. 1, 1918. Serial No. 256,418. 7 Claims. (Cl. 180—21.)



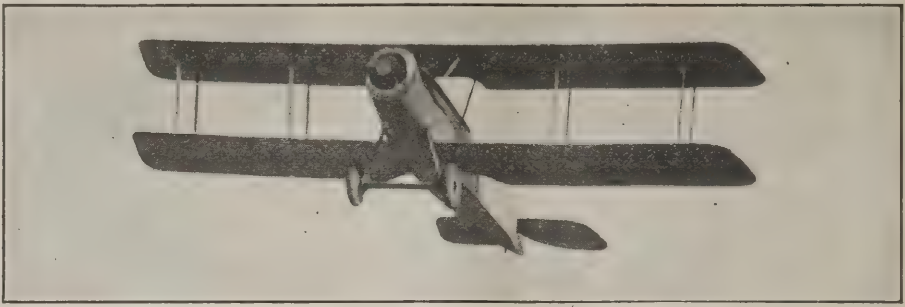
1. A device of the character set forth comprising a frame, a fork pivoted to the forward end of said frame, a drive and ground wheel journaled to said fork, means rotating said wheel, ground wheels carried by the frame, and means carried by the frame for supporting the same in the air when the device is in motion.

1,332,462. COMPASS-OBSERVING APPARATUS. CHARLES FRANKLIN BUSH, Philadelphia, Pa., assignor of one-eighth to Charles H. Woertz, Philadelphia, Pa. Filed Feb. 11, 1919. Serial No. 276,366. 3 Claims. (Cl. 88—1.)



1. Apparatus of the character described including a supporting structure; an instrument thereon; a mirror adapted to reflect said instrument; an observing tube made of telescope sections through which said reflection of said instrument can be observed; means to which said support is movably attached; and means for moving said support relatively to the means to which it is attached whereby an observer on said first means can change the position of said instrument and tube substantially as described.

THE VE—7 TRAINING AEROPLANE



The VE-7 machine was designed as an advanced training aeroplane to be put into quantity production as the standard type for the U. S. Army Air Service.

The work of designing this new type was started in November of 1917. The initial sample machine was delivered to the government for test on February 11, just ninety-one days from the date on which the order was received.

After most successful tests at Hazelhurst Field, Mineola, N. Y., the machine was shipped in March, along with several duplicates, to the Airplane Engineering Department, McCook Field, Dayton, O., for official flight and mechanical tests under the supervision of foreign and American aircraft officials, who were all unanimous in praise of the machine and its exceptional qualities.

Then in May of 1918, the aeroplane was extensively tested in open government competition with seven other makes. It was given the topmost rating by the official Test Board and the other machines graded from it, with the additional recommendations that if the VE-7 be "used for all training, primary and advanced, a saving in time would result as the student would be capable of at once handling a service type machine without having to be put through the 'stepping-up' process, as is at present the case."

The aeroplane is designed around the 150 HP Hispano-Suiza 8-cylinder aeronautical motor, driving a direct connected two-bladed tractor airscrew. The entire power-plant unit, with all accessories, is mounted in a detachable forward section of the fuselage.

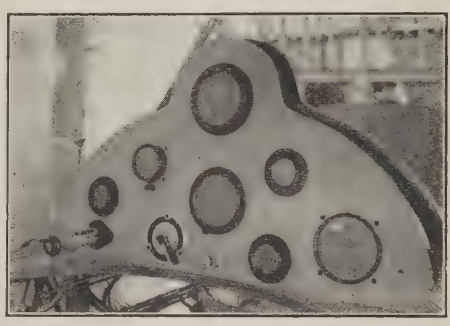
This motor installation has been very carefully worked out, component parts being easily accessible for adjustment and repair. The entire unit presents an admirable mechanical aspect, based on the designer's wide experience on the field and particular association with the Hispano engine.

In order to maintain the highest possible efficiency of the power-plant throughout the wide range of flight temperatures and barometric conditions, a number of effective accessory units are integrally built into the machine. Among these are the adjustable water radiator shutters operated from the cockpit and the thermostatically controlled oil cooling radiator, together with a necessary altitude adjustment for carburetion, operated by hand lever.

A patented, combination air, fuel, and pump manual controller is located on the dash-board which gives positive control over all pipe lines from either fuel tank, and, in addition, approved safety relief valves are fitted to the tanks themselves.

To minimize fire risk the carburetor is equipped with an over-flow pipe leading outside the engine compartment and the air intakes are through screened metal funnels extending up through the top cowl.

Several other points in detail design indicative of the care with which the general problem was handled by the designer, are the instrument board installation and the method of running all fuel and air lines along the left side of the fuselage in a q. d. protective conduit of pressed aluminum, and all the electrical wiring in a fibre lead on the right hand side.



Pilot's instrument board, VE-7 'plane

Door for access to instruments, VE-7 'plane

Thus all piping and wiring are unit bench assembled and are simply put in place and connected up on fuselage final assembly. Also all instruments are work-at-able through large doors in the cowl bulk-heads as shown in the photographs, being design features promoting reliability and stimulating careful up-keeping, which latter trend has been especially sought throughout in designing.

Among the novelties in parts designed are the unusual strut sockets and incidence wire attachments, the landing chassis, tail-skid unit and the highly original dual "stick" control, the latter a complete unit bench assembly fitted into the fuselage by only four bolts.

Light weight has been secured throughout the machine by common-sense designing and elimination. Every part has specific functions and particular reasons for its incorporation and detailing. And in the designing multi-functioning of its parts is evident everywhere.

But in this proven robust design the machine has very high safety factors throughout and was the most uniform design ever sand tested by the Government. Utter simplicity has been the key-note, ever tending toward ease and reliability in manufacture and contributing much toward satisfactory field service.

In fact, one attribute most desired by the Army Air Service was extreme ease of production and low manufacturing costs, together with low up-keep expense.

Aside from its great performance and wonderful flying qualities, the VE-7 machine is really beautiful to look at. Its lines are very trim, every detail, external and internal, being splendidly "cleaned-up" and worked out to a nicety depicting a finished product, and, as a complete whole, the job is strikingly proportioned.

The finish on the machine rivals that of the finest automobiles, and for once, it can be said that aerodynamic and mechanical superiority over the foreign product has been achieved.

In regard to performances, it can be said that the machine has been designed for high speed and fast climb, and for high efficiency at prescribed altitudes around eight to ten thousand feet, at which height the machine is neutral.

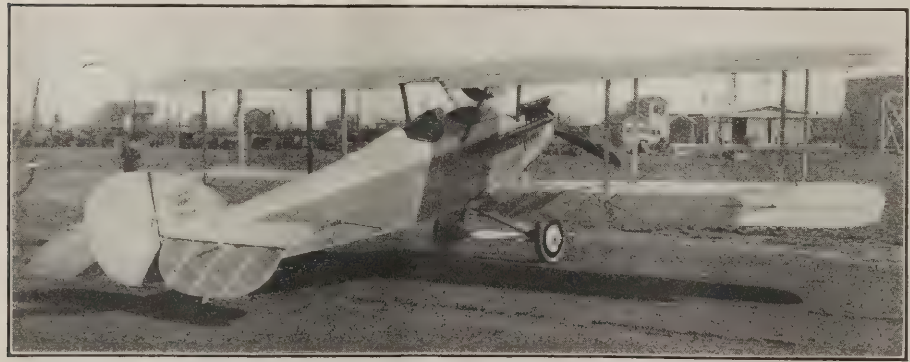
The high speed at sea-level, fully loaded, is 110 miles per hour, ranging down to 48 m.p.h. safe low speed, giving a speed range of over 230 per cent. The speed at 10,000 feet altitude is 105.5 m.p.h. and at 20,000 feet slightly over 94 miles per hour.

In climb, the following performances are given by the A.E.D., machine fully loaded: To 1,000 feet—43 seconds, 5,000 feet in 4 mins. 33 secs., 10,000 feet in 11 mins. 50 secs., 15,000 feet in 22 minutes and 20,000 feet attained in 43 and one-half minutes. The service ceiling appears to be around 20,750 feet, with maximum altitude attainable about 22,000 feet.

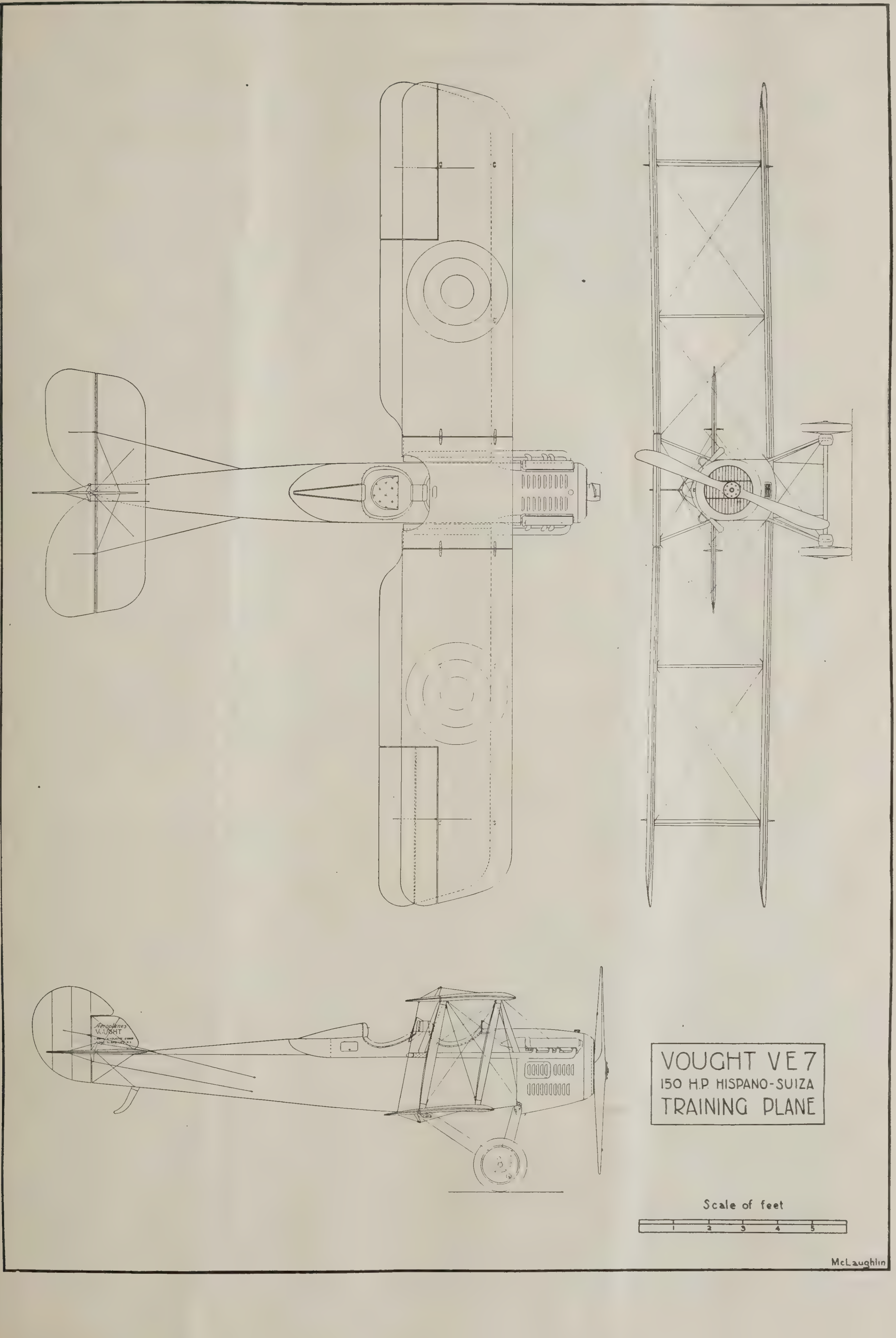
A full throttle flight radius of two and one-quarter hours at sea-level is provided by two fuel tanks, while an oil capacity of five gallons is taken care of in a supplementary tank in series with the main oil pump and radiator.

The weights given out for the VE-7 aeroplane are just over 2,000 pounds total flight load, including the useful load of 525 pounds and 78 pounds of cooling water.

(*Continued on page* 114)



Three-quarter rear view of the VE-7 Advanced Training Aeroplane



VOUGHT VE 7
150 H.P. HISPANO-SUIZA
TRAINING PLANE

Increase Your Income and Help Aeronautics B

BELIEVING that we can do more for the development of aeronautics by establishing an **Aeronautic Circulating Library in every community** than by any other method, not excluding large government appropriations, we invite the co-operation of progressive men and women, readers of this magazine, who would like to participate in this progressive movement **by establishing an Aeronautic Circulating Library in their community,** which will become a center and clearing house of aeronautic activities in their community, just as the **Aeronautic Library** of New York has been the clearing house of aeronautic activities in New York.

Six years of experience have proven that an Aeronautic Library is a powerful factor and the headquarters of aeronautic activities with far-reaching influence.

More people visit our Bookshop at 299 Madison Avenue, New York City, each day than visit ten clubs. These people come and write from every part of the world, ask our advice, guidance and information—which we gladly supply.

The Aeronautic Library was founded in 1914, as a philanthropic information bureau and free library. Then the demand for books became so large that the purpose had to be extended to include the publishing and selling of aeronautic books, magazines and maps and the distribution of aeronautic articles of a literary, scientific or artistic character; to seek, collect, distribute and make public authentic information relating to our nation's aeronautic needs; to foster the upbuilding of our aerial defenses, encourage scientific research, develop the national aeronautic resources and arouse active public interest in aerial travel and aerial transportation.

As very little existed at that time in the direction stated above, we had to do the pioneer work in this line—which we undertook with pleasure. We started out to be purely a philanthropic service organization, but the demand for aeronautic books and magazines alone became so large as to make the Library an extensive business enterprise.

People of all classes and all ages come to our Bookshop. They know they are welcome; and we are glad to supply them with information and advice. They can look over and read books and magazines free of charge, and read the latest aeronautic news on the bulletin board. Inventors and experimenters bring us their models and exhibit them in our Shop. Aviators come to plot out their flights on our maps, and like engineers, and students and others, come regularly to buy the latest copies of "Aerial Age Weekly", "Flying", "Air Power", and other magazines and the latest books and aeronautic maps. Scores of men, women and young people come to borrow books, buy flying model aeroplanes, aluminum model planes to be used as automobile radiator ornaments, statuettes, aeronautic jewelry, and other aeronautic articles and souvenirs.

Often a limousine stops at the Library and a young boy or girl comes in, accompanied by the father or mother, to buy a toy aeroplane. Soon they become interested in the many aeronautic things they see and end by booking for aeroplane flights, joining the Aerial League of America, acquiring aeronautic books and a "Winged America" for their library, an aluminum model aeroplane for their automobile radiator cap, subscribe to aeronautic magazines. They then go forth into the world to carry the wonderful message of aerial progress, which sends us other people who invariably do likewise.

Banks call to inquire regarding the standing of firms and individuals; exporters inquire about manufacturers who can supply planes, motors, and accessories; lawyers send their clerk to consult the textbook on Aerial Laws and inquire regarding the latest legal decisions; insurance companies call for data on aeronautic risks; chambers of commerce and committees call to find what aviators are available for exhibition flying, and for information about requirements for landing fields; prospective buyers call to find out where they can buy aeroplanes, motors and accessories of all kinds. During the war scores of young men would call to find out how to join the Air Service, and relatives would even call to inquire whether we knew the whereabouts of their boys overseas, or to ask how they could assist their boys in passing their examinations, getting advance training, get transfers to better fields, get their flying pay. Others would seek information as to how they could help to obtain larger aeronautic appropriations, how they could effectively oppose the cutting of the flying pay, etc., etc.

The secret of our success has been that we have rendered and are rendering valuable service in a pioneer and distinctive line of human endeavor.

INCOME FROM AERONAUTIC LIBRARY WILL MORE THAN PAY FOR OFFICE AND CLERK FOR LOCAL AERO CLUB OR AERIAL LEAGUE

IT is a fact that many automobile clubs derive substantial incomes from the sale of maps, guides, gasolene and supplies.

Many Aero Clubs and Aerial Leagues would be established and would be able to do effective work if they could support an office and a clerk. This they can do by establishing an aeronautic library in connection with the Aero Club or Aerial League offices. The Library's customers will become members of the organization and the members of the organization will become customers of the Library. One helps the other—and both help the development of aeronautics.

If you have not as yet an Aerial League in your community write to Major Charles J. Glidden, Aerial League of America, 280 Madison Avenue, New York City, who will be glad to advise you how you can organize a section of the Aerial League of America in your community.

ing an Aeronautic Library In Your Community

HOW YOU CAN ESTABLISH AN AERONAUTIC LIBRARY AS A PROFITABLE AND PERMANENT BUSINESS

YOU can establish an Aeronautic Library (which will bear the name of your community) in connection with almost any activity in which you are engaged, if you have a shop or an office to use, or you can establish it in partnership with the local newspaper, hotel, book or stationery shop, insurance, real estate, or other similar enterprise.

The Pensacola, Florida, Aeronautic Library is located in the Hotel San Carlo, the leading hotel there; the Cincinnati Aeronautic Library is operated in connection with the Pan-American Aircraft Company; the Manila (Philippine Island) Aeronautic Library is connected with an aeroplane agency; aeronautic libraries are being established in China, Brazil, and Bolivia in connection with aircraft agencies, one is being established in Texas in connection with an Aero Club. An Aeronautic Library makes an attractive addition to almost any business or organization.

For less than one thousand dollars we establish your Library and supply you with the necessary stock of aeronautic books, magazines, maps, art works, model aeroplanes, aeronautic jewelry, propeller clocks, goggles, and other aeronautic novelties and articles required to make your Aeronautic Library attractive and complete. We advertise your Library free in our advertisements, so that all the people interested in aeronautics in your community will call on you and become your customers—and also become members of your Aerial League, if you decide to organize a League.

Your Library thereupon becomes not only the aeronautic center and clearing house in your community, but also the distributor and selling agent for all the aeronautic books, including the Aeronautic Reference Library, which consists of six large textbooks dealing with the six main branches of the Aeronautic Science and Art, as follows:

The Textbook of Applied Aeronautic Engineering.

The Textbook of Aerial Laws and Regulations for Aerial Navigation.
The Textbook of Aero Engines.
The Textbook of Naval Aeronautics.
The Textbook of Military Aeronautics.
The Aero Blue Book and Aeronautic Directory.

Also distributor for the following aeronautic magazines and maps; and articles:

AERONAUTIC MAGAZINES:

(1) "FLYING" (monthly), founded 1911, the largest and leading aeronautic magazine in the world which gives a broad survey of developments of aeronautics the world over. $4.00 a year; foreign $1.00 extra.

(2) "AERIAL AGE WEEKLY," founded 1912, the national aeronautic technical and trade paper which gives technical articles by leading authorities, and reports all current events and business prospects in aeronautics. $5.00 a year; foreign $2.00 extra.

(3) "AIR POWER" (monthly), founded 1915, publishes articles by leading authorities on military and naval aeronautics and illustrated review of world progress in military and naval Aeronautic Art and Science. $3.00 a year; foreign $1.00 extra.

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(1) Official Aeronautical Wall Map of U. S. and Canadian Airways, giving the geographical aeronautical divisions of the North American Continent, the rules of the air, etc., $5.00 a copy. 50 x 43 inches, giving names of all communities on the Airways.

(2) Official Wall Map of the World's 1,100 Airways, with distances between places in miles and kilometers all over the world, connections between air lines and steamship lines and railroads, magnetic deviations, longest periods of daylight at different latitudes, etc. $5.00 a copy.

(3) Aeronautic Maps of different airways and portions of the United States.

MODEL AEROPLANES:

Model aeroplanes guaranteed to fly, different sizes and prices.

The "Liberty" automobile aluminum Radiator Cap Ornament, which is supplied in two types:

Type "A" with Automobile Radiator Cap Attachment, price $5.00.

Type "B" Paper Weight and Desk Ornament, price $6.00.

Also distributors and selling agents for propeller clocks, aeronautic jewelry, souvenir miniature propeller paper knives, rare aerial mail stamps with the cancellations of all the first aerial mail trips, which will attract all the stamps collectors in your community and other attractive articles and novelties for which there will be a large sale, especially during the Thanksgiving, Christmas and New Year's seasons.

For some of these aeronautic books there is a wide demand. For instance, every lawyer, insurance agent and doctor in your community should have a copy of the Textbook of Aerial Laws, because it is the only book that gives the adopted international, national and state aerial laws, aerial insurance information and international air medical standards.

Your chamber of commerce, city officials, banks, newspapers and business men and other people will want the wall map of the airways, which shows on that airway where your community is located.

A great many progressive people will want books and magazines because they want to be connected with the aeronautic movement in this pioneer stage, when it is beginning to extend its usefulness to every branch of human endeavor, and the tremendous strides forward of aeronautics open wonderful possibilities for the employment of ingenuity, genius and skill and business opportunities as great as were opened by the railroad, automobile and telegraph industries. And there are problems of engineering as huge as were solved by the world's master builders; juridical questions to be decided as stupendously difficult as a statesman ever was called upon to settle; possibilities for the development of international relations greater than were ever conceived; problems of transportation to be solved by the application of aircraft as complex as have ever confronted economists; opportunities to gain distinction dazzling enough to satisfy the most ambitious.

Every automobile owner is a prospective buyer of an aluminum plane for his automobile radiator cap; and every boy is a prospective buyer of model aeroplanes, and you can teach boys to fly these models and organize them in teams and arrange to have them compete for the Aerial League of America's trophies and prizes offered for model contests.

Your Aeronautic Library will make you the Community's Aeronautic Advisor and will lead to popularizing aeronautics, establishing landing fields, standardizing aerial laws and regulations and insurance rates, extension of aerial mail service, creating demand for aerial transportation and to other important developments which will help the progress of aeronautics and of your community.

If you are ready to establish an Aeronautic Library in your community write for full information to

THE AERONAUTIC LIBRARY, Inc.
299 Madison Avenue New York City

(*Continued from page* 110)

General Dimensions

Span, both planes	34′— 3″
Chord, both planes	4′— 7½″
Clear gap between planes	4′— 3″
Stagger	—11″
Length overall	24′— 2″
Height overall	8′— 7½″

Areas (square feet)

Main planes	297.
Stabilizer	19.
Fin	2.30
Ailerons	37.42
Elevators	17.09
Rudder	7.8

Main Planes

Four aileron type, with cut-away top centre section. Wing section, Vought, No. 6. The incidence is differential.

No sweepback. Dihedral, 1¼°. Wings are in five units, assembled together with submerged hinges. Internal lateral control mechanism.

Spars are of selected spruce, I-beam section, re-enforced at panel points. Ribs are of unit assembly type, built up of spruce and ash battens, with poplar webs, while for miscellaneous parts ash, birch and cedar are employed.

The internal bracing system utilizes double swaged wires and forked ends attached to stamped mild steel fittings anchored to the main spars through neutral axels.

Main plane fittings are submerged and the strut sockets are designed flush to the wing surfaces.

Wing frames are covered with approved linen, or cotton fabric, specification sewed to ribs and "pinked" taped. Surface treatment is 5 coats of acetate dope and two coats of special grey enamel.

Inter-plane struts are of selected spruce, solid one piece design, tapered slightly. The strut section is of very low head-resistance.

Cellule bracing is Roebling 19-strand cable, fitted with Standard turnbuckles for adjusting means. Flying wires are doubled, landing wires single.

Fuselage

Carefully cleaned-up design of extreme simplicity. Fittings incorporate special anti-drift details. The frame is a box girder ,of steel and wood construction, unit type except for detachable engine mounting, with trussing of double swaged wires.

Cross-section, rectangular but crowned top and bottom, tapering to a vertical knife edge at the rear. Dimensions at maximum section, 40½ in. deep x 30 in. wide.

Motor housings and cowling are of stamped sheet aluminum, after portion being fabric covered.

Cowlings enamelled light blue, fabric doped and grey enamel finished.

Large, hinged vision doors render motor parts, control mechanisms and tail-skid system readily inspected and accessible.

Seating

Two seats, in very comfortable tandem arrangement, in well protected and upholstered cock-pits. Front seat between wings, well forward to obtain vision. Cut-outs in upper centre section and lower wings facilitate vision from rear seat.

Exceptional vision provided. Cock-pits fitted with re-enforced windshields.

Longitudinal weights very close-coupled.

Empennage

Composed of fixed, double cambered stabilizer, connected dual elevator flaps, fixed vertical fin and balanced rudder. All frames are of steel, welded and brazed together, wood rib filled, over tubular steel and spruce spars.

System internally braced with swaged wires and carried externally by crossed cables and turnbuckles, giving a most rigid tail construction to withstand high stresses in "stunting."

Empennage locked in place to fuselage by a series of exclusive Vought design features.

Tail units covered with wing fabric and finished to match. Doubled control wires connect up all control surfaces.

Chassis

Type, Vought "V" strut and dual wheel design. Entire chassis quick detachable by removing 4 hinge pins.

Wheels are 26 x 4 in., shod with Goodrich Cord Tires. Re-enforced stub axles of nickel steel operate in metal guide, with floating type shock-absorbers assembled onto metal spools.

Axles, spreader tubes and shock-absorber group well streamlined with stamped metal housings.

"V" members of chassis are of selected bent ash, shock-absorbers of Goodrich ⅝ in. diameter elastic cord, cotton sheathed. Wheels fitted with detachable stream-line fabric covers and special oiling device.

Every member in the complete chassis unit is pin connected, with adequate safety locks, giving great demountability, desired flexibility and ease of production.

Metal parts finished in blue enamel, baked on, while wood members are given three coats of water-proof varnish.

Tail-Skid

Patented design. Floating type skid, semi-universal and self-aligning in action. Is fitted with rubber cord shock-absorbers and renewable metal shoe. Assembly get-at-able through doors in side of fuselage. All parts quick-detachable.

Radiator

Special honey-comb type, located in nose of fuselage, housed in polished aluminum shell. Is equipped with dash-board controlled shutter system to regulate cooling. Total water capacity in circulating system is 9¼ gallons. Long distance water thermometer installed.

Oil radiator protruding below the under cowl is provided in the oiling system. Including the capacity of the oil tank, the circulating system holds a total of five gallons of lubricating oil, sufficient for over four hours wide open flying.

Fuel Tanks

Two in number, main under rear seat, other in cowl between engine and dash-board, front cock-pit. Total fuel capacity is 31 gallons, sufficient for over 2¼ hours at wide open throttle around sea-level.

Carburetor supplied by mechanical pump incorporated in motor. Hand air pump on dash for starting.

Fuel shut-off cocks in both cock-pits.

Mufflers

Long sheet steel tubular exhaust pipes extending along sides of fuselage back to rear cock-pit, one on each side. Designed to keep all smoke and oil away from operators and from soiling the machine.

Pipes supported by forged swivel brackets.

Controls

Dual stick control of new design, combined with standard type adjustable foot rudder-bars. Control system assembled as unit and installed with 4 bolts only. Engine throttle lever and altitude adjustment control provided in both cock-pits. Starting magneto crank in rear cock-pit only. All controls have thumb-screw tension locking devices. Levers and parts nickel plated, polished.

Starting

Self-starting of engine obtained by special hand operated starter magneto. Rear dash equipped with Lunkenheimer hand primer to motor to facilitate cold weather starting.

Safety ignition switch visible to mechanic cranking also provided.

Instruments and Equipment

Altimeter, air-speed indicator, Waltham clock, tachometer, gasoline and oil pressure gauges, primer, Boyce L. D. thermometer, fuel controls and Dixie switch, all neatly arranged on unit dash-board.

Equipment includes fire extinguishers, safety belts, small tools roll and miscellaneous small parts replacement kit.

Engine

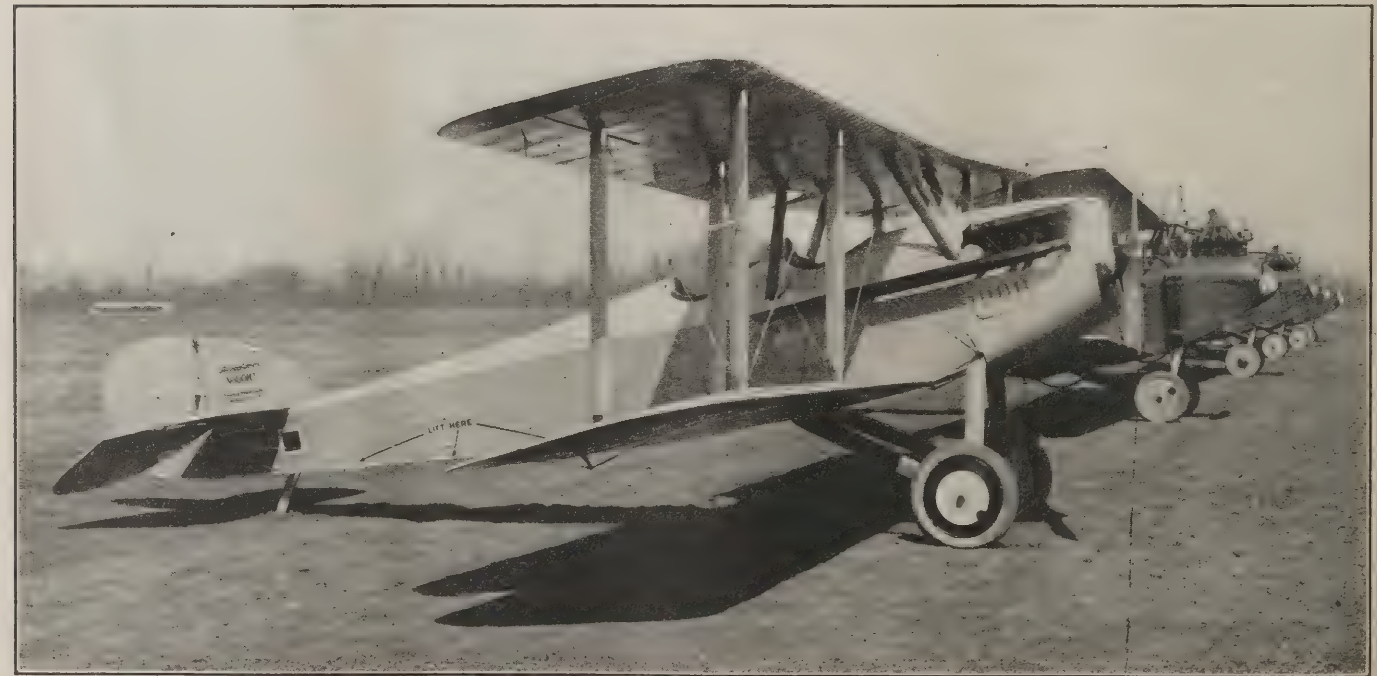
Hispano-Suiza, 8 cyl., 150 h.p., water-cooled type, Model A.

Propeller

Liberty 2-bladed, walnut, 8 ft. 4 in. diam. x 5 ft. 5½ in. pitch.

Factor of Safety

A uniform factor of safety of 9 plus has been proved for the design by the latest French methods of sand loading, being about 40 per cent greater strength than shown in exhaustive tests by other machines in the same class.



Detailed view of the VE-7 Advanced Training Aeroplane, showing the machine ready for a test flight at Dayton, Ohio

NAVAL *and* MILITARY AERONAUTICS

Army Air Expedition Nearing the U. S.

Headquarters of the Army Air Service has received a dispatch from Capt. St. Clair Street, commanding the New York-to-Nome and return flying expedition, saying that four machines of the squadron started from White House, Alaska, for Wrangell, 300 miles distant, on September 9th, but only Airplane No. 4, in charge of Lieut. Ross Kirkpatrick, succeeded in getting through to Sergeif Island, ten miles from Wrangell, the three others being forced to return because of fog before reaching Telegraph Creek. Lieutenant Kirkpatrick flew over the Llewelyn and Taker glaciers. Another start was made from Telegraph Creek on September 10th. the three ships coming down at Glenoria landing place. In landing, Lieut. C. H. Crumrine's machine broke an axle. Captain Street obtained the necessary repairs parts from the steamer "Hazel B." His message of September 12th said he expected to take off with the three machines from Wrangell on September 14th. Lieutenant Kirkpatrick was ordered to continue to Prince George, B. C., if the weather permitted. Better continuous weather conditions were expected after leaving Jasper, Alberta, Canada, as the expedition will then be out of the high mountainous regions where fog and heavy winds prevail much of the time. The distance from Jasper to Mitchel Field, Long Island, N. Y., the starting point, is 2,350 miles, according to the route laid out for the flight, while the distance from Jasper to the United States border is only 780 miles. Flying conditions in general from thence home will be far better than was the case in either Canada proper, British Columbia, Yukon territory or Alaska.

Nome Flyers Race Home

The first of the Nome flyers, who left Mineola, L. I., on July 16, to fly to Alaska, is expected to arrive at Mitchel Field on the return trip shortly.

Officials at the field said that they had been advised by telegram from Lieut. Ross C. Kirkpatrick that he arrived at Prince George, B. C., on September 18, and was not going to wait for the other three flyers, but would come on alone. The trip seems to have become a race.

Another telegram from Capt. St. Clair Street, head of the flyers, advised that he and Lieut. Nutt and Nelson had left Telegraph Creek, Alaska, on September 19 and reached Hazelton, but were forced to put back because of bad weather.

Navy Improves Air Transmitter Equipment

Capt. George W. Steele, Jr., U.S.N., commanding the Air Detachment, U. S. Atlantic Fleet, has reported to the Navy Department that the transmitting equipment installed on Navy aircraft recently modified to operate on the new standardized wavelength, has proved entirely successful under tests. The installation of distant control for ignition system has practically eliminated all ignition noises, both on the trailing antenna for receiving and on the radio compass coil. This reduction of ignition noises permits intercommunication between aircraft in flight for distances up to ten miles. With the ordinary installation such communication is practically prohibited except when flying in comparatively close formation.

British Air Expert in Washington

C. I. R. Campbell, naval constructor and superintendent of airship construction for the British Admiralty, called at the Navy Department on September 14th and advised with Capt. T. T. Craven, Director of Naval Aviation, relative to the construction of rigid dirigibles. Mr. Campbell was pleased with the advance made by the Navy Department in the construction of hangars and gave some interesting details as to plans for airship construction overseas.

Army Airship Fleet Drills at Langley Field

Army air service officials have received a report on the first fleet maneuvers of dirigible airships held at Langley Field. Three semirigid craft participated, and under command of Capt. Bryan B. Daggett, fleet commander, battle evolutions, including an attack formation, were carried out in the air above Hampton Roads and the naval base.

The French-built airship Zodiac, officially known as the ZD-1, was the flagship, commanded by Capt. Dale Mabry. She is a 300-foot vessel, and carried three officers and ten men during the maneuvers, which lasted two hours and fifteen minutes. The other craft were the C-2, a navy type "blimp," commanded by Lieut. Bruce Martin and carrying two officers and eight men, and the A-4, a training ship, Lieut. Winford Clare commanding.

A 400-foot Italian ship is soon to be added to the army fleet. Arrangements for its purchase have been completed.

Officers Transferred to Air Service

Special Orders No. 188-O, War Department, dated August 11th, effects the transfer of the following officers, regular army, from infantry to the Air Service:

Lieut.-Col. Ira F. Fravel and Majors W. S. Wuest, Barton K. Yount, Henry H. Arnold, Henry B. Clagett, John F. Curry, Jacob E. Fickle, William J. Fitzmaurice, Benjamin D. Foulois, Alfred H. Hobley, John W. Simons, Rush B. Lincoln, Ira Longanecker, Henry C. K. Muhlenberg, William F. Pearson, William E. Gillmore, Harry Graham, Harry W. Gregg, Roy C. Kirtland, John D. Reardon, Albert L. Sneed, John S. Sullivan.

Radio Maneuvers Warships

Experiments just completed by the United States Navy prove that 12,000 and 13,000-ton battleships can be successfully maneuvered by radio from land stations operating directly upon the steering gear at a distance of from four to five miles. Reports of these tests, which were conducted off the Virginia Capes with the battleships "Ohio" and "Iowa," have been received by Rear Admiral Griffin, chief of the Bureau of Steam Engineering. The experiments will, it is stated, revolutionize all future sea flights, as they prove that unmanned ships loaded with high explosives and fire ships can be directed with unerring accuracy against an enemy fleet.

The G. A. X. Aeroplane

A new aeroplane, carrying a 1-pound cannon in addition to a battery of machine guns of all sizes, and protected with an armorplate of ⅜-inch steel, has been developed by the Army Air Service.

The new plane is propelled by two Liberty motors of 400 horsepower each and can attain a speed of 110 miles an hour. The steel armor of the new battle plane, which is almost a flying fort, covers three-quarters of the fuselage and all of the working parts. The comfort and safety of the pilots and passengers are insured by a width of five feet in the fuselage. The new plane is known as the G. A. X. model.

Underneath the 37mm. or 1-pound cannon, the G. A. X. has two machine guns, which fire automatically, while the heavier piece is being trained, and so protects the gunner. There are three Lewis machine guns in front of the pilot and three to the rear. Under the post of the observer three guns are mounted on a movable platform, which permits it to be aimed in any direction while the plane is in flight. In all there are fourteen machine guns on the plane.

To make it still more deadly a war weapon, the G. A. X. has a Whitehead torpedo slung underneath the fuselage. It has a capacity of 200 pounds of TNT. The torpedo can be aimed with a fair amount of accuracy, and dropped by releasing a control in the observer's compartment.

The Army Air Service is also developing the Lepere armored triplane, similarly equipped with a one-pound cannon and machine guns.

Admiral Wells Inaugurates Novel Plan for Inspection of Big Base

What was possibly the first inspection tour of a naval base in history was made by Admiral Roger Welles, commandant of the naval base of San Diego, when he took to the air in the big blimp B-18, making a complete inspection tour of the entire base from the cockpit of the big ship, and proved himself a good flier of the lighter-than-air department and is now quite enthusiastic about the novel plan of inspection and likes the air, staying aloft more than an hour, thoroughly enjoying his first cruise in a lighter-than-air craft. The old time custom of piping an admiral aboard the ship and the time-honored "side-boys" were not present when the admiral stepped aboard his new flagship the big dirigible.

FOREIGN NEWS

Plan Chinese Aerial Mail Service

The Chinese Government is contemplating the establishment of an aerial mail service between Pekin, Hankow and Shanghai. It is estimated that 100 aeroplanes would be required for this service, and British, French and Italian manufacturers' representatives are already on the ground endeavoring to secure this business.

Aerial Mail Services in French Indo-China

The aerial mail service now being organized in Indo-China will comprise thirty aeroplanes of the Bréguet type, and will cover all towns from Hanoi to Haiphong, to Nam-Dinh and to Thaihguven.

Sinn Fein Seize Aero Mails

London.—A band of Sinn Feiners disguised as British soldiers captured the official mails being taken by aeroplane to the military at Bantry.

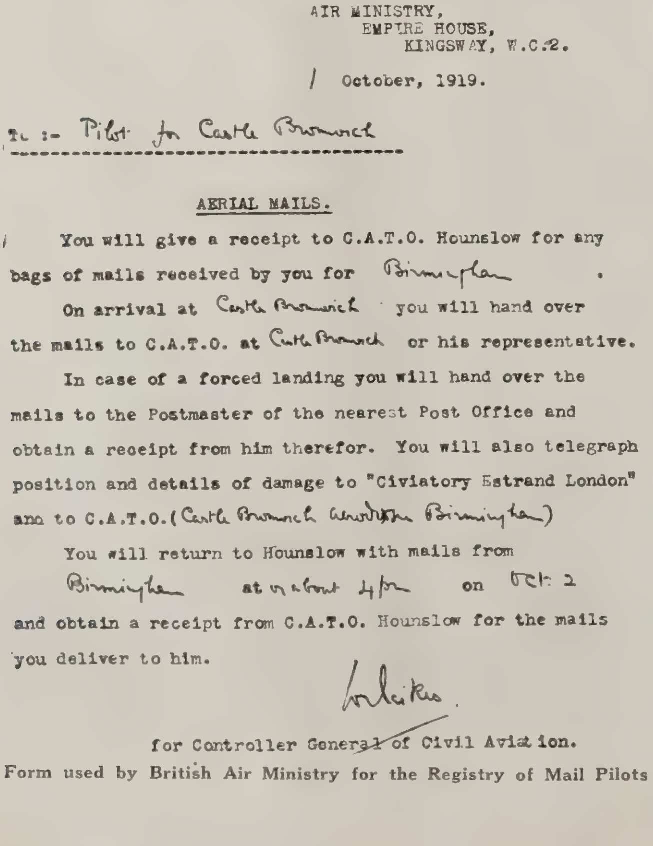
It had been customary for the aviators to drop the bags into a white circle marked on the ground, where waiting soldiers took charge of them. Near to the military quarters in Bantry district on Sunday afternoon the Sinn Feiners copied this device with success. They made a large circle which the aeroplane pilot, seeking the khaki-clad men standing by, mistook for the destination of the mails. He dropped a bag, which the Sinn Feiners seized. No trace of the thieves has been discovered.

Civil Aviation in England

Commercial aviation, although still in its infancy, is making steady progress in England. In view of the fact that only towards the end of last year did it become possible to institute services between the United Kingdom and the Continent, the present position is fairly satisfactory. At that time Aircraft Travel and Transport and Handley Page were the only companies running services, for which the former—the pioneers—charged £21 single and £42 return for the 2½ hours journey between Hounslow and Le Bourget, while the latter subsequently started their service, charging £15 15s. each way and making the trip in 3½ hours.

Following upon this beginning, four recognized routes have been established, viz., London to Paris, Brussels, Amsterdam and, the only internal route, Glasgow, while in addition to Aircraft Travel and Transport and Handley Page, Instones, Blackburn Aeroplane Company, and, but in these cases rather irregularly, several other firms initiated services. These four main routes now have well ordered services operated by several companies, and by a natural course of competition, fares have been very materially reduced, the Instone Company initiating the rate cutting by commencing a Paris service with the fare £12 single or £21 return. This was immediately followed by the Aircraft Company reducing its fares to £15 15s. single and £25 return, to which the Instone Company replied by a further reduction to £12 single and £18 return, and Handley Page by quoting fares £10 10s. single and £18 return. Freights vary from 1s. 3d. to 2s. per lb.

The mail service has been cheapened and materially improved, and letters need no longer be posted at certain London offices. Letters from London to Paris are now carried at a charge of only 2d. in excess of the usual 2½d. postage.



AIR MINISTRY,
EMPIRE HOUSE,
KINGSWAY, W.C.2.

1 October, 1919.

To :- Pilot for Castle Bromwich

AERIAL MAILS.

You will give a receipt to C.A.T.O. Hounslow for any bags of mails received by you for Birmingham.

On arrival at Castle Bromwich you will hand over the mails to C.A.T.O. at Castle Bromwich or his representative.

In case of a forced landing you will hand over the mails to the Postmaster of the nearest Post Office and obtain a receipt from him therefor. You will also telegraph position and details of damage to "Civiatory Estrand London" ana to C.A.T.O.(Castle Bromwich Aerodrome Birmingham)

You will return to Hounslow with mails from Birmingham at or about 4pm on Oct. 2 and obtain a receipt from C.A.T.O. Hounslow for the mails you deliver to him.

for Controller General of Civil Aviation.

Form used by British Air Ministry for the Registry of Mail Pilots

It may be of interest to note that Brown Bros. of London, the well-known factors of motor and cycle parts and accessories, have now issued a most complete catalog and handbook of parts and accessories for the aircraft industry. This publication is the only one of its kind which has so far been issued, and comprises not only a priced catalog, but essential data, specifications, standards, etc., and should be extremely useful to aircraft constructors and designers, aerial transport companies, flying schools, etc.

Brown Bros. are of course factors only, and do not manufacture, but such enterprise as they have shown in producing a handbook of this kind (the first in the world, so far as is known) should go a long way to prove that confidence in the future of commercial aviation is by no means lacking amongst British firms. Brown Bros. are prepared to quote for any of the items listed, and have intimated that overseas officers of this department can be supplied with a copy of the handbook in cases where it is thought a reasonable prospect of business exists.

Crewless Aero Carries Mail

An aerial torpedo which can be controlled thousands of miles away has been invented by Charles S. Price, a prominent British mechanical engineer.

Carrying no crew, but under absolute control to any distance at which wireless is effective, the torpedo can be used for exploration, observation or carrying mails. It actually has been used by the British war office during hostilities for bombing purposes. It makes photographs, and the inventor declares he has practically completed an invention by which the effects of the bombing raid can be recorded at home simultaneously with the raid itself, which may take place thousands of miles away.

"The torpedo can travel from 175 to 200 miles an hour, and I can tell at any moment just where it is," said Mr. Price.

"The Germans called it the 'devil's airship.' One German who was a butler in England during 1915 offered me on behalf of the German government $5,000,000 for the secret. He was locked up in the Tower of London as a spy."

Mr. Price declares he can steer the torpedo to New York, Australia or any other part of the world from any wireless station in Great Britain.

The Completion of a Great Flight

On Aug. 29, Lieuts. Parer and MacIntosh, who had left Sydney for Bathurst on the way to Melbourne, damaged their machine in a bad landing near Culcairn. The aviators were forced to land owing to magneto trouble and mistook a ploughed field for grass-land. The machine was so badly damaged as to be beyond repair. The aviators proceeded to Melbourne by train.

The Australian Defence Department lent the aviators another machine with which to finish their flight. The aviators motored to the railway junction at Albury to fetch this machine, and then flew back to Culcairn in order that their flight would not be broken.

On Aug. 31, Lieuts' Parer and MacIntosh arrived at Melbourne, and landed on the Flemington Racecourse. They were accorded an official welcome. The bottle of whisky which had been brought intact from London was presented to Mr. Hughes, the Australian Premier, upon their arrival.

The Australian Aircraft and Engineering Co.

The Australian Aircraft and Engineering Co. have been the first in the field in establishing an aerial mail service in Australia. By arrangement with the Deputy Postmaster-General, a trial flight was to be carried out between Lismore to Tenderden and back, calling at Casino on the out and home journeys. The weight of mail was not to exceed 200 lbs. with passenger, or 250 lbs. without passenger, and the pilot was to call for and deliver the mail at the post office at each of the places mentioned.

On June 26, an Avro piloted by Mr. F. L. Roberts covered the distance of 81 miles in an hour's flying time, the company receiving verbal congratulations from various authorities.

A further experiment in aerial mail carrying from Sydney to Lismore, a distance of 300 miles, passing over Newcastle, Kempsey and Grafton, was to be demonstrated later.

The Tour of Lieut. Roget

On Sept. 1, Lieut. Roget, who is making a tour of Europe, arrived at Rome from Athens.

Lieut. Roget left Paris on June 9th. He hoped to make a non-stop flight to Warsaw, but was forced to land at Berlin. His route from there was via Posen to Warsaw on June 10; Lemberg, June 22; Bucharest, June 28; Constantinople, July 4; Athens, July 17.

It appears as if some delay must have occurred at the last-mentioned town, or on the flight thence to Rome. The tour was made with the idea of taking observations on the climatic conditions of the countries through which he passed.

Brazil

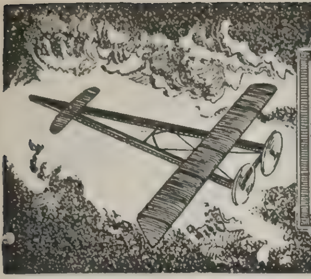
The Minister of War has acquired already in Europe two Spads and four Avros, and has completed the arrangements for two more Spads, four Breguets, and one S.V.A. The last seven machines have been bought by public subscription for the international service between Montevideo, Rio de Janeiro and Santiago de Chile, in accordance to the ideas of Captain Cesario L. Berisso.

A French Dirigible to Visit Brigue

In connection with the forthcoming unveiling of the Chavez monument at Brigue, the French Government has asked permission from the Swiss Government to send a dirigible to the ceremony. The Swiss authorities have replied favorably, but pointing out the grave dangers due to the violent wind currents in the Brigue district.

German Machines for Japan

It is expected that Japan will receive her share of aircraft surrendered by Germany, before the end of the year, and that it will include 50 aeroplanes, among them some of the most recent types. The Japanese Government has voted a credit of 500,000 yen for the construction of hangars at the military aerodromes of Tokorozaiva and Kagamigahara, to shelter the machines when they arrive in Japan.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

CLUBS

PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.
TRIANGLE MODEL AERO CLUB
Baltimore, Md.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.
CAPITOL MODEL AERO CLUB
1726 M Street, N. W. Washington, D. C.
AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., N. Y. City
AERO CLUB OF LANE TECHNICAL HIGH SCHOOL
Sedgwick & Division Streets, Chicago, Ill.

The Curtiss Model

Before attempting to build the Scale Model Curtiss J N 4-B shown in the accompanying drawings, I would advise the model builder to construct a full size drawing from the dimensions I have given. A full size drawing would save time and trouble and each part could then be cut to the exact length before assembling, which would save considerable work in constructing the model. Without a drawing the model builder would have to cut each part and then attempt to fit it in the machine, with the result that it would be the wrong shape or size and another part would have to be made.

To construct the model proceed as follows: lay out each side of the fuselage first. Care must be taken when cutting the longerons. The fuselage you will notice is 22⅞" long, but the longerons are curved and of course should be ¾" longer to allow for bending. To bend, I would advise holding over a jet of steam emerging from a kettle and slightly straining until the proper shape is reached. If possible, I would advise the model builder laying the drawing on a flat piece of wood and placing tacks along the outside edge of the fuselage lines and bend the longerons around these, which would save time, give the correct shape, and insure against the snapping of these members. When shaped put the struts in place and fasten by applying a little glue to the end of the strut and then use a very small nail to hold in place. It may be necessary to drill a small hole to guard against the splitting of the wood.

When two sides are finished put in the top and bottom struts. The plan of the top and the bottom of the body is shown at the lower left of the drawing. The model builder will notice that the top struts are shown clearly and the bottom struts are supposed to come directly underneath the top, except where the struts are shown by dotted lines, these are bottom struts and are placed to take care of the slant of the wing side struts.

Next make the motor stick, which consists of a special shaped fitting at one end and a hook for fastening the rubber at the other (I may mention that all the fittings such as propeller shafts, wheels, struts, sockets, wood, bamboo, etc., used in this and all the models following, may be purchased from a Model Supply House.

To complete motor stick place a ball bearing propeller shaft in the fitting at the front of the machine. I would advise fastening the motor stick in two places only and about two inches apart at the front of the machine. This is best, because when rubber is twisted to give power to the propeller it has a tendency to twist the motor stick, and if this was fastened all along the body it would twist the body out of shape.

The landing chassis is made of ¼ x ⅛" wood cut to the lengths specified after which they must be made to a streamline shape. I would advise making little plates of thin brass to fasten the struts together and also to fasten the struts to the fuselage, but if the model builder thinks he could do the work better some other way he is at liberty to do so. The axle is a regular 6" x ⅛" Brass axle and the wheels 2" in diameter. After placing landing chassis fittings in place on the fuselage, place a wing strut socket directly over it, to take the wing spars when we will finish them.

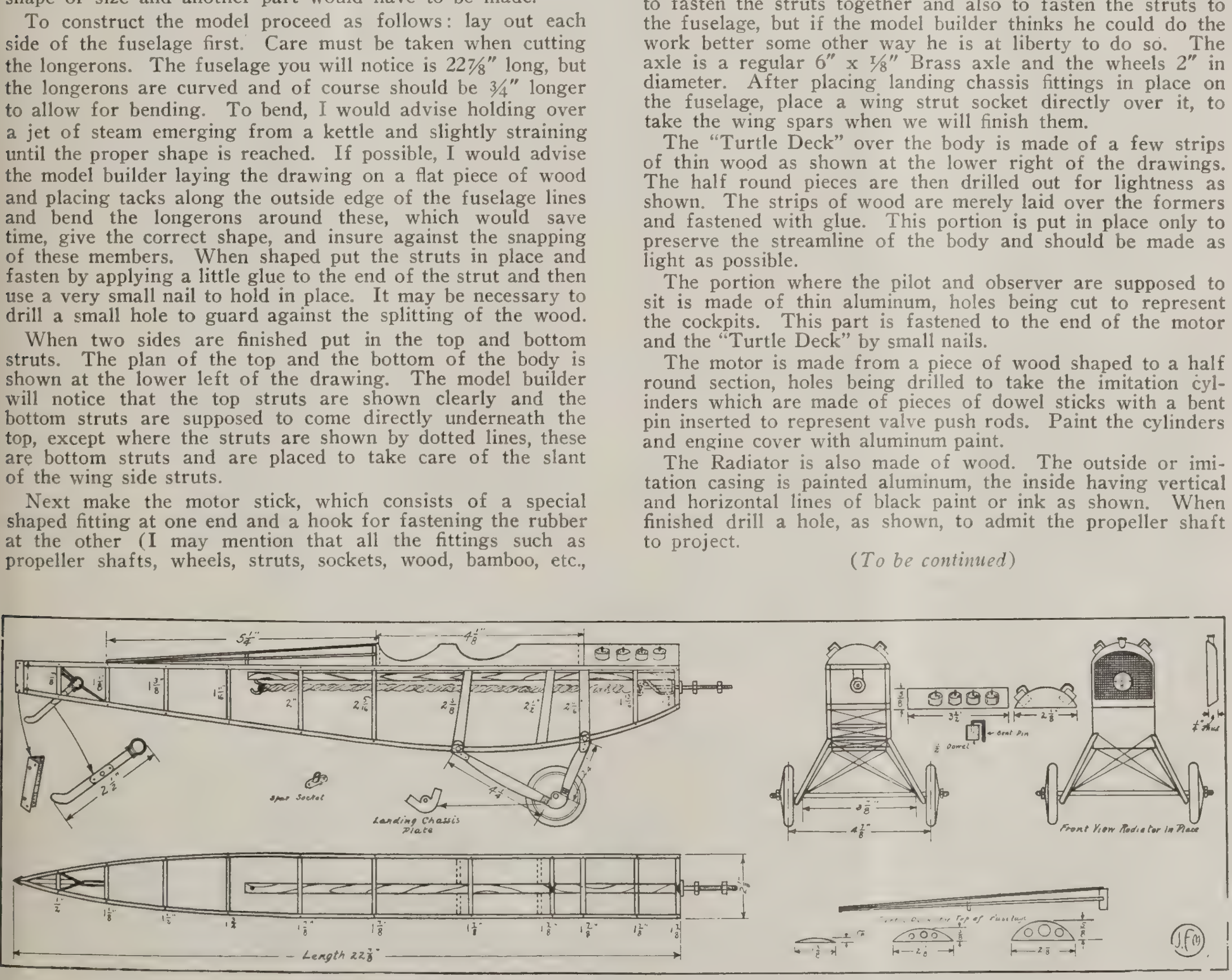
The "Turtle Deck" over the body is made of a few strips of thin wood as shown at the lower right of the drawings. The half round pieces are then drilled out for lightness as shown. The strips of wood are merely laid over the formers and fastened with glue. This portion is put in place only to preserve the streamline of the body and should be made as light as possible.

The portion where the pilot and observer are supposed to sit is made of thin aluminum, holes being cut to represent the cockpits. This part is fastened to the end of the motor and the "Turtle Deck" by small nails.

The motor is made from a piece of wood shaped to a half round section, holes being drilled to take the imitation cylinders which are made of pieces of dowel sticks with a bent pin inserted to represent valve push rods. Paint the cylinders and engine cover with aluminum paint.

The Radiator is also made of wood. The outside or imitation casing is painted aluminum, the inside having vertical and horizontal lines of black paint or ink as shown. When finished drill a hole, as shown, to admit the propeller shaft to project.

(To be continued)



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Wall Street Explosion and Our Anti-Aircraft Defenses

"Wall Street looked as if it had been bombed by air raiders," says a newspaper. This should remind us that our anti-aircraft forces have been disbanded.

* * *

The Aerial Police was on the job. Captain Horace Keene and Captain Mark Ovenden were in Wall Street when the bomb went off and escaped with a shaking—unless they surrendered their ducats to some broker before the explosion, which we have reason to believe they did not.

The African Aerial Police

Raisuli, the notorious African bandit chief has at last met his nemesis. Aeroplanes are being used to raid his camps, and all his shrewdness and ability to strike and get away are of no avail.

The Saharian aerial police have established a remarkable record for efficiency in the past four years and have the bandit business an unsafe occupation een in the African desert!

The Annual Aerial Migration

The annual aerial migration will soon be under way. Our straw hats have been reluctantly relinquished, our palm beach, flannels, white shoes and other summer apparel have been put away, and Jacquith has notified us that he is going to Florida—as he has done annually for many years.

There will be a great many aviators in the South this winter—and California will lead in aerial activities. K. M. Turner, the energetic pioneer, president of the Aero Club of Southern California, states that Los Angeles is to be the center of aerial activities of California. George B. Harrison and Roy Knabenshue, two other pioneers, support Mr. Turner's assertion—what about it, Pacific Aero Club?

Air Laws

Some people are urging laws to govern aviators, and complain because there are no air laws; others complain that individuals connected with aeronautics have an utter disregard for laws; while the accused wish that there were no laws!

A couple in the west who were married in an aeroplane and were somewhat in doubt as to the validity of the ceremony, are, according to press statement, going to quote the Textbook of Aerial as authority in the event of the validity of their marriage being challenged.

Misusing the Tail Skid

Just because you have a tail skid, and it can stand rough usage, there is no excuse for using it to plow the aerodromes. It only increases the high cost of flying and makes a few fellows temporarily profane.

Insurance

At times you wonder how the insurance people were inveigled into writing insurance for certain people—and so does the insurance agent, after the crash.

The Night Bombers

To Lieut.-Col. J. T. Babington, R.A.F., "OUR C.O."
By Capt. Paul Bewsher, D.S.C., R.A.F., in "AIR PIE"

Dusk is our dawn, and midnight is our moon;
And for the sun we have the silver moon:
We love the darkness, and we hate the light;
For we are wedded to the gloomy night.
When in the East the evening stars burn clear
We know our time of toil is drawing near;
For as the evening deepens in the West
It brings an ending to our day-long rest.

One after one we slip into the gloom,
And through the dusk like great cockchafers boom;
High in the stars you hear our mournful cry,
As we sail onward through the sapphire sky.
The twilight shadows welcome in our day,
The silver dawn will hurry it away.
The golden stars act as a changeless guide—
The gloomy skies our wanderings will hide.
The Rhenish cities hear our throbbing hum,
And o'er the Belgian coast we go and come.
From Zeebrugge to Metz our name is cursed,
At every township where our bombs have burst,
The cunning searchlights haunt the midnight skies,
Where chains of emerald balls of fire rise,
To mingle with the spark of bursting shells—
High in the darkness where the bomber dwells!

Across whole countries we move to and fro
As on our restless pilgrimage we go:
With tanks filled up with petrol and with oil,
With loaded bomb-racks—all the night we toil.

We know the meaning of the lights which shine
Upon the world beneath—each is a sign,
Which tells us of some dim and frightened town,
Which dreads to hear our bombs fall whistling down.

Or of some railway junction full of dread,
Whose workers hear us thunder overhead,
And darken every lamp—that we may pass
And leave no twisted rails and shattered glass.

We know the meaning of the sudden glare
Of dazzling light which blossoms in the air.
For us the green and scarlet rockets blaze
And whisper urgent secrets through the haze.

The dials with their phosphorescent face
Record our passage through the star-lit space;
Our height, our speed, the lapse of time is told
By steady fingers—calculating, cold.

Above a strange and darkened world we ride
And over dim mysterious forests glide:
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—Courtesy *The Aeroplane and Auto Age.*

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Here's a new variation of an old one:

Back in the spring of 1918 an officer intercepted Private Wheeler, a giant backwoodsman from Maine, wearing a boche helmet and an air of grandeur. He came out of the clouds, however, at the sharp query:

"Who gave you permission to wear German issue?"

"Please, lootnant," he stammered, "don't make me give this up. I had ter do away with seven Jerries ter git my size."

The officer looked over his gargantuan proportions and his eyes widened.

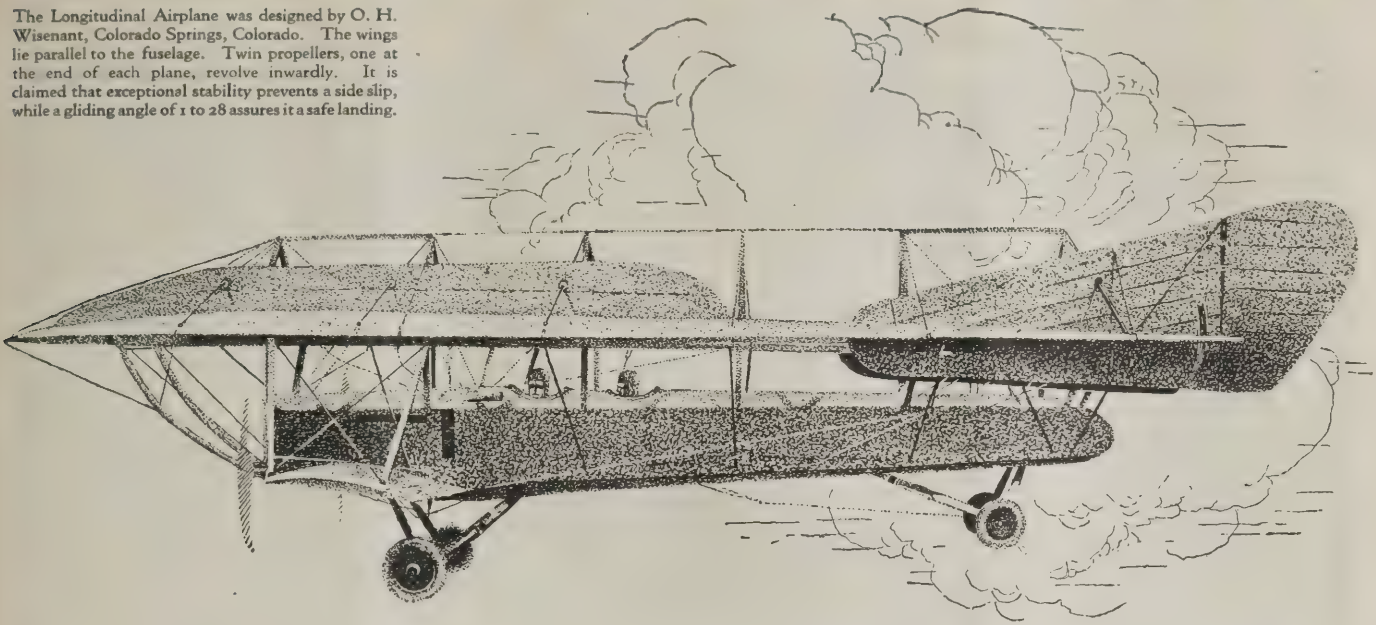
"My God, man!" he exclaimed. "If you ever lose your shoes, the war's over."

Not for Her

He (calling from bedroom) Mary, would you wear these striped pants down town tonight?

She—You poor boob, do you think I want to get pinched?

The Longitudinal Airplane was designed by O. H. Wisenant, Colorado Springs, Colorado. The wings lie parallel to the fuselage. Twin propellers, one at the end of each plane, revolve inwardly. It is claimed that exceptional stability prevents a side slip, while a gliding angle of 1 to 28 assures it a safe landing.



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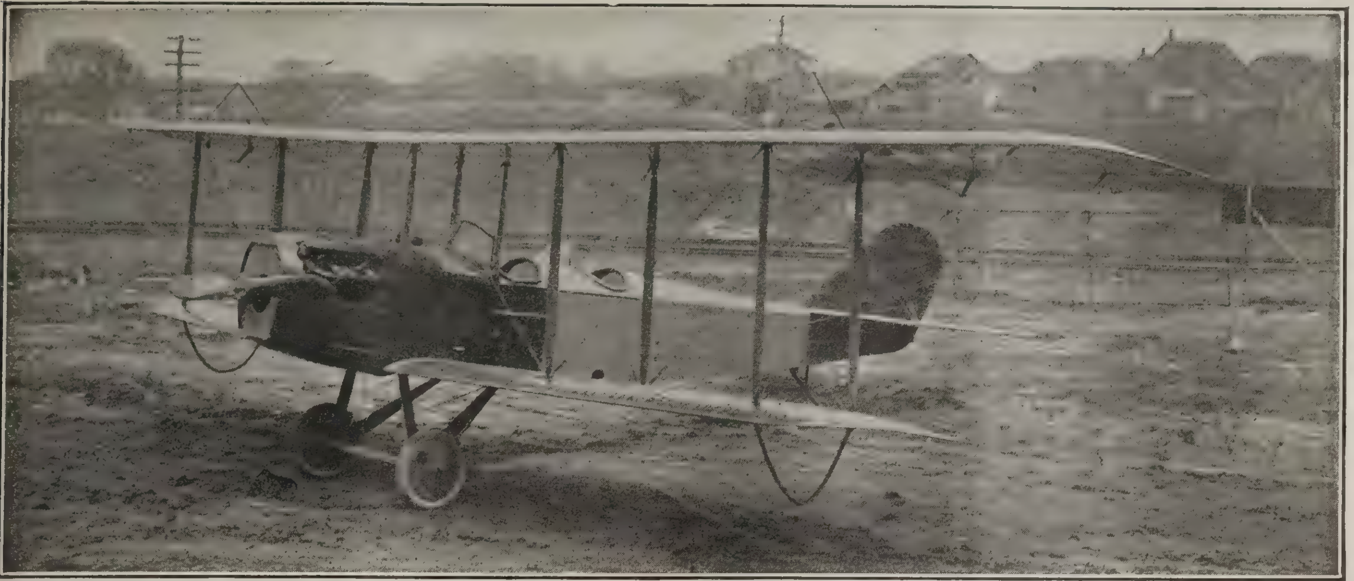

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(*Continued from page* 102)

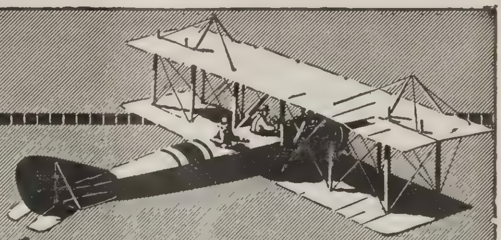
"Truly, the time is ripe for men to step in this marvelous branch of human endeavor and achieve here what the Vanderbilts, the Huntingtons, the Harrimans, Edison and Ford achieved in their respective branches of human endeavor, and the Aerial League of America, by its nation-wide campaign may find and bring to the Aeronautic Movement future Vanderbilts, Huntingtons, Harrimans, Edisons and Fords of the Air.

"The world is waiting for great men to come who will be the great builders of airways, of transcontinental air trunk lines, of huge fleets of transatlantic airships, bridging the New World with the Old each day, and of brilliant lawyers to solve juridical problems created by the international nature of aerial navigation; of insurance and admiralty law experts to apply their knowledge to aeronautics, and progressive men from every line of human endeavor to apply their knowledge of perfecting and extending the use of aircraft and solving the problems of aerial navigation.

"The League can hasten their coming by hastening the advent of large aircraft.

"When I consider that in my short lifetime I have seen human flight evolute first from a dream to a hope, then from a hope to a possibility, then from a possibility to a reality, then into a powerful deciding military factor, and now I am seeing the advent of aerial transportation and the use of aircraft to solve most difficult problems of transportation and for a hundred other utilitarian purposes, I cannot help feeling that it is a provilege to be living in such an age, and to have been a factor in bringing about these developments.

"Therefore, I consider it a privilege to have the opportunity to offer $5,000 in prizes to be awarded in a contest for designs for aeroplanes capable of carrying twenty, fifty, one hundred, two hundred tons of useful load, under rules and regulations to be decided upon by the Board of Directors of the League."



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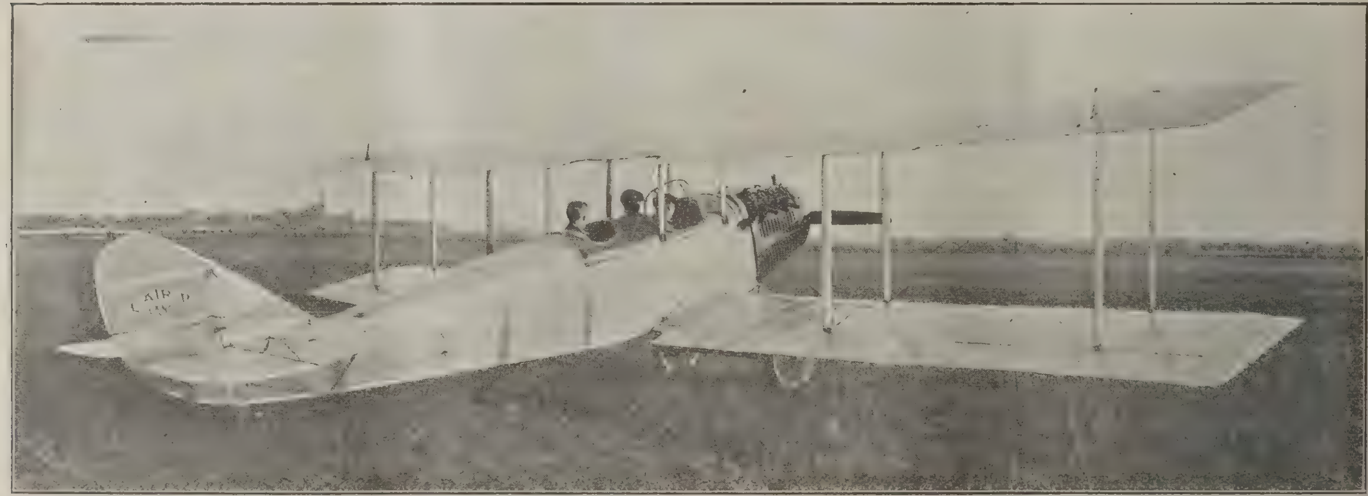

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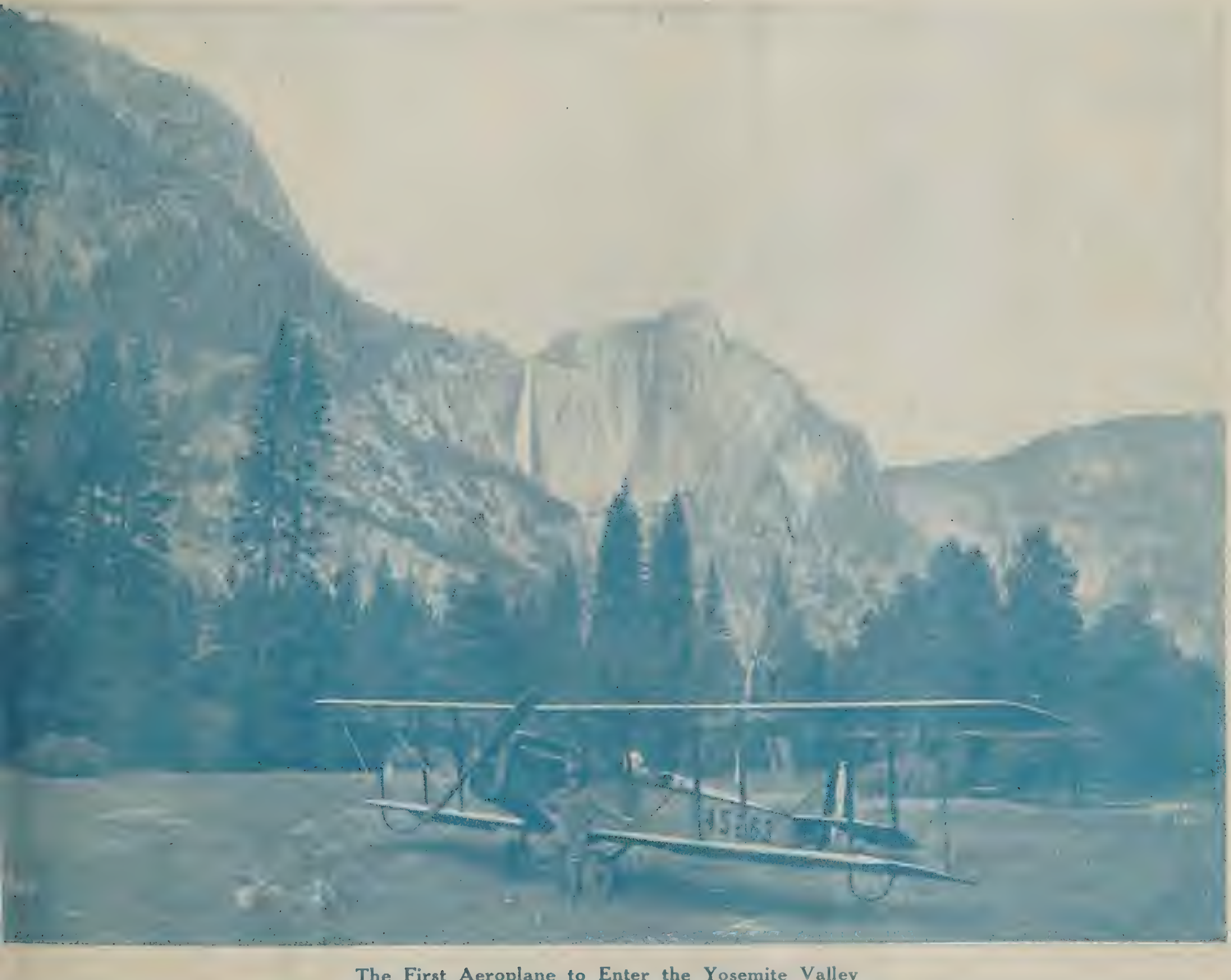

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U. S. Pat. No. 1,185,727, April 13, 1915, U. S. Pat. No. 1,216,189, Feb. 13, 1917. Other Patents Pending

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VOL XII. NEW YORK, OCTOBER 11, 1920 No. 5

COMMERCIAL AND MILITARY VALUE OF CONTEST FOR DESIGNS FOR PLANES LIFTING FROM TWENTY TO TWO HUNDRED TONS OF USEFUL LOAD

"AS soon as you can show us that we can carry from twenty to fifty tons of merchandise by air, across the Atlantic or across the continent in two days, there will be no time lost on our part, but we'll proceed to use aircraft. Transportation is our business and speed is a most desirable factor. The public wants speed in transportation and as aircraft give us revolutionary speed, we are going to use aircraft for transportation. But we must have large aircraft to combine economy with efficiency."

Thus a leading shipping man stated the readiness of the shipping interests to use aircraft.

"If you produce large planes you won't have to look for Vanderbilts, Harrimans and Huntingtons of the air," said another.

"Large torpedoplanes," said a naval offcer, are needed and will be most potential weapons. The Aerial League of America and Mr. Henry Woodhouse deserve the highest praises for instituting this epoch-marking contest."

"The educational value of this contest cannot be overestimated and will make it possible for both the navy and the army to ask Congress for appropriations for large aeroplanes. Without this preliminary public education it would be too much to expect Congress to grant appropriations for a number of aeroplanes costing half a million dollars apiece," said another officer.

The above are only some of the expressions of approval and praises received by the Aerial League of America following the announcement of the offer of Mr. Henry Woodhouse of $5,000 to be awarded in prizes for the best designs of aeroplanes capable of lifting twenty, fifty, one hundred, one hundred and fifty, and two hundred tons of useful load.

Naval Engineers and Constructors Interested

Naval engineers and constructors have inquired regarding the construction of large aeroplanes. They were impressed by the prospects of constructing aeroplanes of such great tonnage and expressed practical ideas on the subject. No doubt combining aeronautic engineering knowledge with naval engineering knowledge will bring substantial results.

Information Regarding Status of Aeronautic Engineering

We have received many inquiries for information regarding the status of aeronautic engineering, designs of the world's largest aeroplanes, and other data. This information and data is contained in the new monumental Textbook of Applied Aeronautic Engineering, which gives over 500 drawings, diagrams and photographs of the world's aeroplanes and is a cyclopedia of aeronautic engineering. It also gives tables and suggestions for the distribution of ten thousand square feet of wing surface, limits in construction of triplanes and quadruplanes, possibilities in the construction of multiplanes and tandem planes, extensively illustrated with diagrams and photos of triplanes, quadruplanes and tandem planes, besides the illustrations and descriptions of the world's aeroplanes.

The Textbook of Applied Aeronautic Engineering can be obtained from The Aeronautic Library, Inc., 299 Madison Avenue, New York City, $6.50 postpaid.

Tandem Planes Represent Solution to Problem?

As pointed out in the Textbook of Applied Aeronautic Engineering, "The best possible solution that suggests itself is that the 10,000 square feet or over of wing surface be distributed in tandem planes. But what should the tandem planes be? Monoplanes? Biplanes? Multiplanes?

"The first noteworthy experiments with tandem planes were made by Samuel P. Langley. Since then a number of experiments have been made with tandem planes but few of the experimenters have had the opportunity of testing triplanes and getting aerodynamical data so as to ascertain the relative efficiency of tandem planes. This is a tremendous field and here the aeronautic engineers will have to find the correct relation between surfaces that are disposed one above the other and in tandem planes, the distances between the planes or groups of planes. If three or more sets of planes are to be used, then the problems multiply, for, then will come in again the problem of finding proper relation between the gap and chord, distances between sets of planes and of the reduction to a minimum of parasite resistance."

Applications for information regarding this epoch-making contest should be addressed to the Secretary, Aerial League of America, 280 Madison Avenue, New York City.

COURT OF APPEALS AND FEDERAL DECISIONS SUPPORT CONTENTIONS IN A. C. A. CASE

NUGENT & NUGENT, of 280 Madison Avenue, New York City, attorneys for the petitioner, in their clear and impressive memorandum of law submitted to the Court, on October 1st, quote the Court of Appeals and Federal decisions supporting the plaintiff's contentions, that the so-called "newly elected" governors of the Aero Club of America have no right to office, as follows:

SUPREME COURT—NEW YORK CITY

In the Matter of the Petition to Set Aside the Election of Directors or Governors of the Aero Club of America.
Memorandum of Law for Court

The application of the petitioner herein should be granted and the election of August 16, 1920, declared irregular, invalid and of no effect; the Governors assumed to be elected or appointed thereat vacated and said Board restored to its duly elected and constituted directorate; likewise the officers of said Aero Club of America assumed to be elected by such Board should be removed, the duly elected officials of said Club restored; said By-Laws declared invalid; and all such persons restrained from further exercising functions of a Governor or officer of said Club or pretending so to do.

POINT I

The Court has full power and authority to entertain this proceeding and grant adequate relief:

This application is made under Section 32 of the General Corporation Law, which reads as follows:

> **"Sec. 32. Powers of Supreme Court respecting elections.—The Supreme Court shall, upon the application of any person or corporation aggrieved by or complaining of any election of any corporation or any proceeding, act or matter touching the same; upon notice thereof to the adverse party, or to those to be affected thereby, forthwith and in a summary way hear the affidavits, proofs and allegations of the parties, or otherwise inquire into the matters or causes of complaint, and establish the election or order a new election, or make such order and give such relief as right and justice may require."**

This section was clearly enacted in order that Courts might have power to proceed in a summary manner to test the title of officers of corporations without recourse to the more cumbersome proceedings in a writ of quo warranto. The Supreme Court now has the power to inquire into any corporate election of directors or officers, whether the same is made by the stockholders or members or by trustees or directors to fill vacancies. (Matter of Ringler & Co., 204 N. Y. 30; matter of Empire State Supreme Lodge, 118 App. Div. 616.)

And mandamus would not be a proper remedy. (People ex rel Manice v. Powell, 201 N. Y. 194.)

In Matter of Ringler & Co., 204 N. Y. 30, at pages 39, 40, 41, the Court states per Werner, J.:

> **"The respondent contends that this section was not intended to vest the Court with power to inquire into elections or appointments by a board of directors. The argument is that the language of the statute relates only to elections of the corporation, that is, elections by the stockholders. We shall briefly give the reasons why we think this view of the scope of the statute is too narrow. The statute was clearly enacted in order that courts might have power to proceed in a summary manner to test the title of officers of corporations without recourse to the more cumbersome proceedings under the writ of quo warranto. We are convinced that its history indicates a legislative intent not to confine its operation to corporate elections by stockholders, but to extend it to any corporate election. As originally enacted by Chapter 325, L. 1825, sec. 9 it provides that 'It shall be the duty of the Supreme Court, upon the application of any person or persons or body corporate, that may be aggrieved by, or may complain of, any election, or any proceeding, act or matter, in or touching the same, to proceed, etc. As thus enacted it was carried into the Revised Statutes. (1 R. S. 603, sec. 5.) It is to be noted that the words 'of any corporation' which appear in the present section after the words of any election were not in the statute until it was incorporated into the General Corporation Law in 1890. (Ch. 563, sec. 15.) It is a fact of common knowledge that it was a part of the scheme of this comparatively recent revision of the laws to divide corporations into separate classes, such as business corporations, stock corporations, transportation corporations, etc. The revisers placed in the General Corporation Law all the provisions which they deemed applicable to all classes of corporations. The section with which we are now dealing, as it existed in the Revised Statutes (1 R. S. 605, sec. 11) did not apply to all corporations, and that appears to have been the reason why the revisers changed it by adding after the words 'of any election' the additional words 'of any corporation' so as to make it in terms clearly applicable to all corporations. This history of the statute could seem to indicate that these added words 'of any corporation' were not intended to limit the meaning and effect of the earlier phrase 'any election' but rather to broaden the statute so as to give the Court power to investigate elections in any of the corporations belonging to either of the classes enumerated in the revised corporation laws of 1890. We are, therefore, inclined to think that the Supreme Court now has the power to inquire into any corporate election of directors or officers, whether the same is made by the stockholders or by trustees or directors to fill vacancies. . . ."**

POINT II

The duly elected and constituted Board of Governors and officers of said Aero Club of America were summarily removed from office during fixed terms specified in the Constitution and By-Laws of said Club, against their wishes, and without just or any cause therefor. They were legislated out of office by a group of Governors who secured control of affairs during the absence of a majority of said Board, and took advantage of such opportunity by calling a special meeting of the members under colorable compliance with the By-Laws, but with suppression of facts, thereby securing sufficient proxies to enable them to control such meeting (a vast majority of such members being out of town and unable to attend in person, not acquainted with the facts and who would presume the request to be bona fide, a circumstance counted upon by this group) the desired result being accomplished by purporting to amend the By-Laws wherein such offices were declared vacant and a full new Board of Governors was appointed by a committee selected by the conspirators and new officers selected by this illegal Board; all of which was illegal, contrary to law, and of no force or effect. (Toledo Traction, Light & Power Co. v. Smith, 205 Fed. 643; People ex rel. Manice v. Powell, 201 N. Y. 194; Societa Italiana v. Vicchiarielle, 189 App. Div. 102; Matter of Empire State Supreme Lodge, 118 App. Div. 616; Murdock v. Philips Academy, 12 Pick. 244; Tutler v. School Trustees, 6 Conn. 532; Imperial Hydropathic Hotel Co. v. Hampson, 23 Ch. Div. 1; Rex v. Richardson, 1 Burr 517; See also Thompson on Corporations, Secs. 1080-1084; and Cook on Corporations, Secs. 624-711.)

The comparatively recent case of Toledo Traction, Light & Power Co. v. Smith, supra, 205 Fed. 643 (decided May 16, 1913), involved the question of the control of the traction systems of the City of Toledo, was bitterly contested, the parties represented by able counsel, and the Court, after full hearing, in a well considered opinion, reached the conclusion that directors cannot arbitrarily be removed during a term of office fixed by statute or By-Laws, against their will, except for cause upon notice and hearing. Further, that such directors could not be removed by resolutions adopted at a stockholders' meeting duly called. **That such result could not be accomplished indirectly by amending the By-Laws so as to change the date of the annual meeting and thereby shorten such terms of office and that any such By-Law was invalid and clearly beyond the power of the stockholders to adopt.** In this case the Court per District Judge Killits says at page 646:

> **"It is logical to first consider question of title. Plaintiff claims that because of a change in the regulations of the Local Company which will be treated at length later, a vacation of the offices of the old di-**

rectors and officers was effected on the date last named, and an enlarged directorate, with altogether a new personnel, save one man was then chosen and qualified. Four of the defendants claiming to be directors were regularly chosen at the annual election in January last, held according to the regulations. In one way it is claimed the attempted change in regulations affected these men, and that is that the third Monday of April was named as the day for the regular annual meeting, such change to go into effect in 1913. The result of this change, if legally made, acting in conjunction with an old provision of the regulations readopted in the amendment, which authorized the removal of directors at any special meeting of stockholders called for the purpose by a majority vote, so far as the term of office of these four directors is affected, is to be considered immediately.

"We are clear that the regulation for removal of directors, attempted to be acted upon at the meeting of stockholders April 14th, called for the purpose, is contrary to law, if it is to be considered as authorizing arbitrary removals. NO SUCH POWER INHERES IN THE BODY OF STOCKHOLDERS UNLESS IT IS CONFERRED BY STATUTE. Thompson on Corporations, sec. 1084; Cook on Corporations, secs. 624-711 and cases cited. Such power is not only not conferred by the statutes of Ohio, but section 8704 General Code, detailing what may be provided in the regulations, being silent on this point, by well known rules of interpretation we must hold that the power is altogether wanting. . . .

"The power to remove a director for cause, of course, inheres in every corporation as an incident of its being; but there does not appear in the minutes of the meetings of plaintiff's stockholders that anything but an arbitrary removal of any of the directors named as defendants was attempted. IF THE REMOVAL IS FOR CAUSE, THE ACCUSED DIRECTOR IS ENTITLED TO A HEARING.

"We now come to consider whether the CHANGE OF REGULATIONS PROVIDING FOR AN ANNUAL MEETING IN APRIL RATHER THAN JANUARY, THE OLD MONTH, TO TAKE EFFECT IN 1913, WAS EFFICACIOUS TO REMOVE THE FOUR DIRECTORS IN QUESTION. We are of the opinion very clearly that irrespective of whether the regulations changing the date was properly adopted, it cannot be employed to terminate the tenure of office of either of these four men. All the Ohio statutes speak for annual elections at which directors shall be chosen. . . . (Quoting various statutes.)

"The effect of the language of these statutes is clearly to make the term of a director regularly elected at an annual meeting to be for one year, or until the next annual election, AND THAT NO POWER ABIDES IN THE STOCKHOLDERS, IN ANY METHOD SHORT OF REMOVAL FOR CAUSE, TO SHORTEN THE TERM. WE ARE IN ENTIRE ACCORD WITH THE REASONING IN THAT BEHALF OF THE SUPERIOR COURT OF CINCINNATI IN LUTTERLY v. BREWING CO., 12 OHIO SEC. 67. SEE ALSO THOMPSON ON CORPORATIONS, SEC. 1080. We are therefore constrained to hold that, so far as this action seeks to affect the right of the defendants Meilink, Hofer, Secoz and Weil to serve as directors of the Toledo Railway & Light Company, it must fail, and that consequently Messrs. Taylor, Heator, Winkworth and N. A. Tracy who are claimed to have been chosen to succeed them have no valid title to places on the directorate."

In People ex rel. Manice v. Powell, 201 N. Y. 194, supra, the Court of Appeals distinctly held that without some statute or provisions of the Charter authorizing his removal or suspension, a director cannot be removed or suspended from office until the end of his term, without just cause. The Court, per Chase, J., concurred in by the entire bench, state at pages 201, 202:

"It would be somewhat startling to the business world if we definitely anounced that the directors of a corporation were mere employees and that the stockholders of the corporation have the power to convene from time to time and remove at will any or all of the directors, although their respective terms of office have not expired.

"It is and was prior to the amendment of said certificate of incorporation provided by statute that, an action may be maintained against a director of a corporation to procure a judgment suspending him from exercising his office if it appear that he has abused his trust or to remove him from office upon proof or conviction of misconduct. (General Corporation Law, sections 90 and 91; former sections 1781 and 1782 of the Code of Civil Procedure.) It is provided by section 307 of said General Corporation Law that a director shall not be suspended or removed from office by a court or judge otherwise than by the final judgment of a competent court in an action brought by the attorney-general as prescribed by said section 90 of that act.

"The statute providing for an action in the name of the attorney-general to suspend or remove a director is not exclusive of such reasonable and lawful charter provision relating thereto as may be included in the articles of incorporation. Without some statute or provision of the charter authorizing his removal or suspension, a director cannot be removed or suspended from office until the end of his term, at least without cause. (Thompson on Corporations [2nd ed.] secs. 1084, 1085, 1086; Taylor on Corporations, sec. 649; Cook on Corporations, sec. 711; Morawetz on Private Corporations, secs. 541, 542.) . . ."

The misconduct, excluding cases of conviction of infamous crimes, when warranting the removal of a director and constituting "good cause" therefor, must be specially connected with the execution of the office and also the result of improper motives. (10 Cyc 744 and cases cited.)

In Rex v. Richardson, 1 Burr 517, supra, Lord Mansfield discusses, at length and with great learning, the whole subject of removal of directors and what constitutes good cause and concludes that the grounds upon which directors may be removed from office during their term are as follows:

"First: Such as have no immediate relation to his office, but are in themselves of so infamous a nature, as to render the offender unfit to exercise any public franchise. Second: Such as are only against his oath and the duty of his office in the corporation and amount to breaches of the tacit condition annexed to his franchise or office, and Third: Such as are of a mixed nature, as being an offense not only against the duty of his office, but also a matter indictable at common law."

POINT III

The By-Laws in full force and operation when each of the various members of the duly constituted Board of Governors were elected, specifically designated their term of office.

Sections 1, 2, 3 and 4 of Chapter II of said By-Laws of the Aero Club of America provide as follows:

"Chapter II. Elections—Section 1. The Governors, President and Vice-Presidents shall be elected by ballot by the members at the annual meeting of the Club. The President and First Vice-President shall be persons who are, or who are concurrently elected, Governors of the Club. The polls shall remain open one hour."

"Section 2. The Board of Governors shall consist of twenty-four members of the Club, at least sixteen of who shall be resident members, designated as Governors ,Class A. The remaining eight may be either resident or non-resident members and shall be designated 'Governors, Class B.'"

"Section 3. The Governors, Class A, SHALL HOLD OFFICE FOR THE TERM OF FOUR YEARS and until their successors are elected. The Governors, Class A, shall be divided into four groups of four Governors each, so that the term of office of one group of four Governors, Class A, shall expire each year."

"Section 4. The Governors, Class B, shall be elected ANNUALLY AND HOLD OFFICE UNTIL THE NEXT ANNUAL MEETING OF THE CLUB and until their successors are elected."

It is to be observed that Section 1 of Chapter 1 of the By-Laws of said Aero Club of America provides for the date of the annual meeting as follows:

"Chapter 1. Meetings—Section 7. The first annual meeting of the Club shall be held in the City of New York on the second Monday of November, 1910, at 8.30 P. M. and subsequent annual meetings shall be held on the same day of the same week of the same month in each succeeding year. Notice of such an-

(*Continued on page* 154)

THE NEWS OF THE WEEK

French Pilot Wins Gordon Bennett Race

Estampes, France.—Sadi Lecointe, the famous French aviator, won the international aeroplane race for the James Gordon Bennett trophy on September 28. He covered the course of 300 kilometers, or 186.3 miles, in 1 hour 6 minutes 17 1/5 seconds. F. P. Raynham, the sole British representative, withdrew after covering the first lap.

Howard M. Rinehart and Major R. W. Schroeder, the American entries, both were forced to abandon the race shortly after starting because of difficulty with the mechanisms of their machines. Kirsch of the French team withdrew after covering 200 kilometers. Capt. de Romanet of France, the only competitor besides Lecointe to finish the race, completed the course in 1 hour 39 minutes 53 2/5 seconds.

The race, after having been delayed several hours by adverse weather conditions, was started shortly after 1.30 o'clock in the afternoon. Kirsch, one of the three French entrants, flying a Nieuport machine, took the air and crossed the starting line at 1.37 o'clock.

The weather, which had been cloudy and damp, cleared after noon. The sun came out and the visibility, which had been so poor that the airmen considered it too dangerous to fly, improved rapidly.

Howard M. Rinehart, American, flying a Dayton-Wright monoplane, started at 2.11.10 3/5. Sadi Lecointe of the French trio, flying a Nieuport, got away at 2.08.54. Kirsch, the first starter, made the first hundred kilometers in 21 minutes 29 seconds. Capt. de Romanet, the third French entrant, got away at 1.44.52, and made his first hundred kilometers in 22 minutes 52 /5 seconds.

Major Schroeder, U. S. A., the second American entrant, flying a Verville Packard, started at 2.37 4/5. Sadi Lecointe made his first 100 kilometers in 21 minutes 36 3/5 seconds.

Trans-Canada Flight by Aeroplane and Seaplane

Ottawa.—A trans-Canada flight, halfway by seaplane and the other half by aeroplane, is contemplated by the Canadian Air Board, the effort to be made toward the end of October, according to a statement issued by Hugh Guthrie, chairman of the board. It is felt that the work of the board has now advanced to such an extent that some practical demonstration should be given of the possibilities of air navigation.

It is proposed to start from Halifax, N. S., and to reach Vancouver, B. C., with stops en route at Sault Ste. Marie, Winnipeg and Calgary and other places. Should wind and weather conditions prove favorable, this trip may be made in between 40 and 50 hours, including the time of stops, but a good deal will depend on weather conditions.

Pulitzer Air Race Course Selected

Members of the Contest Committee of the Aero Club of America, under whose direction a speed aeroplane race will be held Thanksgiving Day for the Pulitzer $5,000 trophy, have selected the course for the contest.

Col. B. F. Castle, chairman of the committee, accompanied by Edward McDonnell, William Larned and H. S. Brown, went to Mitchel Field, Hempstead, and made an inspection of the country. The air was fortunately favorable to visibility. Upon return to Mitchel Field announcement was made that a closed circuit of forty miles had been agreed upon.

The start will be from Mitchel Field. From there the course lies southeastward, above Wantagh, Massapequa, Amityville, Babylon, swinging north to Colonial Springs and Central Park, and returning westward to Mitchel Field.

Four laps of this circuit will constitute the race, a total of 160 miles. The course has the advantage that at all times good landing may be made from 1,500 feet in event of trouble, while from the viewpoint of the spectator no terrain in the country offers superior vantage points.

Central Park has a well-kept flying field, large enough for landing at high speed, and there are many natural fields on the circuit. These factors will add materially to the safety of the flyers.

In one respect, the surfacing of the field, the Pulitzer Trophy contest will offer a marked advantage over the Gordon Bennett Cup race, won last week by Lecointe, the French flyer, at Etampes, France. The French flying field was so rough as to make speed landing absolutely dangerous, and until detailed reports dissipate suspicion, it will be believed here that this condition had much to do with the poor showing of the Americans.

Planes entered from this country for the Gordon Bennett Cup are expected to be back in time to take part in the Pulitzer Trophy contest. They are known to be capable of 180 miles an hour or better, so that it is expected the race from Mitchel Field will be finished well within the hour.

Hendon, England, photographed from the air, showing a large number of aeroplanes on the aviation field

Gompers Takes to the Air

Rochester.—Samuel Gompers, president of the American Federation of Labor, arrived in Rochester on Sept. 22 in an aeroplane from Buffalo to address the convention of International Association of Machinists. The trip was made in thirty-nine minutes.

Honeywell Wins Air Race

New York.—Although winners of the national elimination balloon race have not been officially announced, Aero Club officials declared that no other competitor's record was sufficiently close to dispute the victory with H. E. Honeywell, of St. Louis.

Honeywell, flying the balloon "Kansas City II," covered 700 miles from Birmingham, Ala., the starting place, landing at Thamesville, Ont.

Contest committee officials said that Honeywell, with Capt. R. F. Thompson, of the army, and Ralph Upson, of Akron, Ohio, who took second and third places, respectively, according to unofficial reports, would almost certainly be chosen to represent America in the Gordon Bennett international races next month. Telegraphic reports credit Thompson with a flight of 690 miles and Upson with 620 miles.

Following is the official entry list:

Army balloon No. 1—Pilot, Lieut. Richard E. Thompson; aid, Lieut. Harold E. Weeks.

Army balloon No. 2—Pilot, Lieut. Byron T. Burt; aid, Lieut. R. M. Olmstead.

Army balloon No. 4—Pilot, Capt. Dale Mabry; aid, Lieut. G. W. McEntire.

United States Navy—Pilot, Lieut. Raafe Emmerson; aid, Lieut. Frank Sloman.

Pilot, J. S. McKibben; aid, Allen O'Neill.

Pilot, H. E. Honeywell; aid, Dr. Jerome Kingsberry.

Pilot, Bernard Von Hoffman; aid, Willard Heller.

Pilot, William Asman; aid, Capt. J. M. O'Reilly.

Pilot, Ralph H. Upson; aid, W. T. Vann Ormann.

Pilot, R. F. Donaldson; aid, undetermined.

Pilot, A. Leo Stevens; aid, undetermined.

Pilot, Warren Rasor; aid, undetermined.

Trophy to Replace Gordon Bennett Cup

A new trophy to replace the Gordon Bennett cup, which was won for the third successive time by France when Sadi Lecointe was the victor, will be offered by the Aero Club of Texas.

The Gordon Bennett cup races, dating from 1909, when flying was in its infancy, are over, for the trophy is permanently owned by France. The Board of Governors of the Texas club, realizing this, met and authorized their president to offer through the Aero Club of America, a new prize, to be known as the Cox aeroplane trophy, together with a cash prize of $10,000 and other prizes to be announced later.

Rules governing the races for the new trophy are to be made by the Aero Club of America and the Federation Aeronautique Internationale. The donor of the cup is S. E. J. Cox, vice-president of the Texas organization, who went to France with two entries.

Aerial Derby in Wisconsin

First honors in the premier Wisconsin aerial derby which was staged at Milwaukee were awarded, after an official check of the records, to Edward Gardner, pilot of The Milwaukee Journal aeroplane, Lincoln Standard Tourabout, entered by Thomas Hamilton of the Hamilton Aero Manufacturing Co., Milwaukee.

Prize money of $700 was awarded Gardner and the Wisconsin State Pilot Championship cup, The Journal trophy, was awarded to the Aero Club of Wisconsin, of which the pilot is a member.

Expert manipulation of the machine and an intimate knowledge of air currents won the race for The Journal pilot. The time for the 264-mile journey from Milwaukee to Kenosha, back to Milwaukee, thence to Green Bay along the lake shore and return to the Milwaukee air port on Lisbon rd, via an inland route near Fond du Lac, was 3 hours, 25 minutes and 48 seconds.

An Italian—S. V. A.—not entered in the race, made the course in 3 hours, 2 minutes and 29 seconds. This plane, however, made no stops at the controls and did not attempt to abide by the regulations set down for the official derby.

Second money, a $400 purse, was won by Dwight Morrow, who flew a Canadian Curtiss. Lester Younghusband, flying an Oriole, came in third, winning $200, and Grant Smith, flying a Canadian Curtiss, took fourth money of $100.

Because of his fine flying exhibition and good sportsmanship, F. F. Manor, competing for the Lutz-Manor flyers, Oshkosh, was awarded a propeller by the Hamilton Co.

Because of the system of handicaps based on factory speed the planes that completed the course in the shortest time did not win the derby. A strong wind during the race had a tendency to slow up all the planes.

F. F. Manor, flying a J.N.D.-4, finished in fifth place, T. F. Otis, in a Lincoln Standard Speedster, the second Journal entry, sixth. M. K. Riddick, in a Standard J.L., dropped out of the race at Green Bay after the receipt of a long distance telephone call, concerning an important business engagement.

Laird Swallow in Rapid Flight

Messrs. Cyle Horchem and Jack Muneke, of the Central Continental Flying School, Pueblo, Colorado, recently made a very meritorious flight from Wichita, Kansas, to Humphrey, Nebraska, a distance of 285 miles in 2 hours and 35 imnutes, in a Laird Swallow equipped with a Curtiss OX-5 motor. Pilot Muneke is filling a series of outdoor fair contracts.

Aero Limited Passenger Service

The Aero Limited passenger service carried 747 passengers during the month of August, notwithstanding the fact that the U. S. Weather Bureau statistics show that there were twenty rainy days during the month.

Pittsburgh Transportation Company

The Globe Aerial Transportation Company of Pittsburgh, Pa., organized in December, 1919, is now engaged in the business of transportation between cities, carrying passengers, freight and express.

The establishment of an aerial transportation line between New York and Chicago, with landing stations in the following intermediate points: New York; Philadelphia, Harrisburg, Baltimore, Altoona, Johnstown, Pittsburgh, Akron, Cleveland, Youngstown, Erie and Chicago, is being arranged.

The officers and directors of this company are all progressive business men of western Pennsylvania. The officers are: George K. Linderman, President; Elmer Trautman, Secretary; William B. Martin, Treasurer; George W. Mulry, General Counsel.

German in Ocean Flight

London, Oct. 4.—One of Germany's best known airmen will attempt a transatlantic flight about the middle of October, according to a despatch to the London *Times* from Berlin.

He will use an aluminum monoplane built by the Zeppelin Company. It will have four motors. The aviator hopes to make the trip in thirty-six hours. He will take along a spare pilot and several mechanics.

American seaplane piloted by Lt. K. B. Keyes, U. S. N. R. F. flying in the Panama Canal Zone

The AIRCRAFT TRADE REVIEW

Chicago Bankers to Aid Goodyear Tire Co.

The Goodyear Tire and Rubber Company has been saved from a possible receivership and from a probable readjustment or reorganization by the action of Chicago bankers, who have decided to handle new financing for that company, according to information received in Wall Street. The difficulties confronting the Goodyear company have been a matter of discussion for considerable time, and the facts became so well known as to cause the publication in Chicago of a receivership story.

Plans for the new financing have not completely matured, but certain Chicago institutions are committed to a plan to raise at least $25,000,000, and in some quarters it is said that the new financing may aggregate $40,000,000. Despite the decision of Eastern bankers to the effect that they could not see their way clear to finance the Goodyear company's requirements, the story that a receivership was being considered was at no time warranted by the exact situation, and the worst that could happen was a reorganization and readjustment similar to the one of the Maxwell and Chalmers companies. Such a step has been averted and an early announcement from Chicago is anticipated.

Although Eastern bankers will not be the principals in the financing, which is expected to be undertaken under the leadership of the Continental and Commercial Trust and Savings banks and others, they will extend full measure of co-operation with the Western concerns in solving the problem which has been impending for a considerable time. The Western banks took the point of view that the company had weathered the peak of the troubles caused by high inventories and sluggish movement of its products, pointing out that the company was reducing its inventories rapidly, manufacturing 16,000 tires a day and selling 20,000.

The Goodyear Company has no funded debt and heretofore has consummated all its financing through sales of stock. Only a few months ago it offered $20,000,000 of preferred stock and $10,000,000 of common stock to old holders at par for a block of stock consisting of two shares of preferred and a share of common. The company also paid last July a stock dividend of 150 per cent. Last October the company's inventories amounted to $35,566,779, the largest on record, and it is understood that those inventories were increased rather than diminished during the intervening months until recently, when the tide began to turn.

Zeppelin Industry to Be Moved Here

Paris.—The German Zeppelin firm intends to transfer its works from Germany to the United States, it has been learned here through a wireless message sent out from Germany, according to a despatch in the N. Y. *Times.* Under the treaty the manufacture of aircraft of all kinds is so restricted that the Zeppelin factory had been at a standstill. The plan is now to transfer the whole manufacturing plant to the United States and there perfect and build airships capable of making regular journeys across the Atlantic.

It is understood that financial interests in America are concerned in the undertaking, but no details are forthcoming here.

C. M. Keys Named President of Curtiss Company

C. M. Keys, who recently obtained stock control of the Curtiss Aeroplane & Motor Corporation, has been elected president to succeed John N. Willys. F. H. Russell has been elected vice-president in place of Mr. Keys. J. E. Kepperly and W. B. Stratton resigned as vice-president and directors and J. R. Herbert and W. P. Chrysler as directors. Mr. Keys, Henry G. Hotchkiss and J. A. W. Smith have been elected to the board.

The new interests are understood to have been selected at the instance of Mr. Keys, who purchased his stock in the Curtiss works from the Willys-Overland interests. Mr. Keys said he contemplated no change in the active management of the Curtiss concern.

The Diggins School Active

The Ralph C. Diggins Aviation School of Chicago, Ill., have had an active season and have successfully graduated seventeen pilots under the Aero Club of America's regulations and have five more who will complete their course before the conclusion of the season.

In addition to the school work, the Company has carried 4,000 passengers and has filled 120 commercial contracts, as well as doing a great deal of cross-country passenger work.

The Company's field at Ashburn is in excellent condition and an invitation is offered to cross-country pilots to avail themselves of the facilities at any time.

Aerial Surveying of Docks will soon be of great importance to all coastal cities

THE PROBLEM OF THE TURBO-COMPRESSOR

By René Devillers, Ingénieur de L'Ecole Supérieure D'Aéronautique

Translated from the French by Paris Office, N. A. C. A.

REQUIRED EFFICIENCY OF THE TURBO-COMPRESSOR SET.—Making expression (4), force supplied by the turbine, equal to expression (12), force absorbed by the fan, we have finally:

$$(13)\qquad 16{,}575\,\rho_t=\frac{5{,}800}{\rho_v}$$

The product $\rho=\rho_t\,\rho_v$ is the overall efficiency of the set. We thus obtain the required condition:

$$(14)\qquad \rho=\rho_t\,\rho_v=\frac{5{,}800}{16{,}575}=0.35.$$

This requires the turbine to supply an efficiency of 0.64, assuming that the compressor has an efficiency of 0.55.

It appears that at the present time we cannot count on a turbine efficiency, ρ_t, greater than 0.53, and therefore, with a compressor efficiency $\rho_v=0.55$, not on an overall efficiency of more than 0.29.

In the tests made on the Bréguet 14 A_2 with Renault 300 h.p. engine, it was not found possible to re-establish ground level pressure in the carburetor at an altitude of 5,000 meters. It has been shown by calculation that, in order to obtain this result, very careful adjustment is necessary and also special care in reducing losses to a minimum.

Still placing ourselves in the conditions of an altitude of 5,000 meters, let us now seek the value of the pressure P_o which we may hope to obtain in the carburetor with an overall efficiency $\rho=0.29$ of the set corresponding, to $\rho_t=0.53$ for the turbine and to $\rho_v=0.55$ for the fan.

We will still assume the same available energy of 16,575 kilogrammeters in the exhaust gas per kilogram of gas consumed. The force utilized for compressing the corresponding weight, 1.034 kg., of air admitted, will be $0.29\times16{,}575=$ 4,800 kilogrammeters, that is, $\frac{4{,}800}{1.034}=4{,}650$ kilogrammeters or $\frac{4{,}650}{425}=10.94$ calories per kilogram of air.

T_o being the final absolute temperature of the air and T_z its initial temperature equal to the atmospheric temperature, the energy utilized in compression is, in calories, $C(T_o-T_z)$, $C=0.24$ representing the specific heat of the air at constant pressure. From this we can immediately deduce the rise in the adiabatic temperature:

$$(15)\qquad T_o-T_z=\frac{10.94}{0.24}=45.6^\circ$$

As before we will take a surrounding temperature of -13° giving $T_z=260$, whence:

$$(16)\qquad \frac{T_o}{T_z}=1+\frac{45.6}{260}=1.75$$

The ratio between the final pressure p_o and the initial pressure p_z, which is the atmospheric pressure, is then given by the adiabatic formula in which $\gamma=1.4$ is the ratio of specific heat:

$$(17)\qquad \frac{p_z}{p_o}=\left(\frac{T_o}{T_z}\right)^{\frac{\gamma}{\gamma^{-1}}}=1.75^{3.5}=1.758$$

The atmospheric pressure at 5,000 meters being millimeters of mercury, we shalll have re-established in the carburetor a pressure of only $407\times1.758=716$ millimeters of mercury instead of the ground level pressure equal to 760 millimeters of mercury.

Assuming that a pressure of 760 millimeters has been maintained to windward of the turbine, we shall have a positive back pressure at the exhaust of 760—716 = 41 millimeters of mercury, that is, 0.06 kg. per square centimeter. From what we have seen in studying back pressure at the exhaust, there is a resulting loss of engine power of about 1.2% with respect to the power it would supply if the pressure at the exhaust valve were 716 millimeters as at the inlet valve.

GENERAL FORMULA OF THE TURBO-COMPRESSOR.—In order to summarize the preceding statements, we will deduce from them the general formula of the turbo-compressor theory.

Notation:

T_1, Absolute temperature of exhaust gas to windward of the diffuser.

T_2, Absolute temperature of exhaust gas to leeward of the diffuser.

p_o, Pressure of exhaust gas to windward of the diffuser, to be maintained at ground level pressure.

p_z, Pressure of exhaust gas to leeward of the diffuser, equal to atmospheric pressure, expansion being assumed complete.

T_z, Absolute temperature of atmospheric air.

T_o, Absolute temperature of air after compression.

P_o, Pressure of air after compression, to be maintained, equal to pressure on ground level.

ρ_t, Efficiency of turbine.

ρ_v, Efficiency of fan.

$\rho=\rho_t\,\rho_v$, Efficiency of turbo-compressor set.

Taking 1.293 as ratio of the specific heats of the exhaust gases and 1.4 for the inlet air, we have:

$$(18)\qquad \frac{T_2}{T_1}=\left(\frac{p_z}{p_o}\right)^{0.226}$$

$$(19)\qquad \frac{T_o}{T_z}=\left(\frac{p_o}{p_z}\right)^{0.29}$$

The specific heat C at constant pressure is taken as equal to 0.3075 for exhaust gas and to 0.24 for inlet air.

At the outlet of the nozzle the energy of 1 kilogram of exhaust gas completely expanded is:

$$(20)\qquad C(T_1-T_2)=0.3075\,T_1\left[1-\left(\frac{p_z}{p_o}\right)^{0.226}\right]$$

The energy utilized for the compression of the corresponding weight, 1.034 kg., of inlet air, is of the value:

$$(21)\qquad 1.034C(T_o-T_z)=1.034\times0.24T_z\left[\left(\frac{p_o}{p_z}\right)^{0.29}-1\right.$$

Putting the energy supplied by the turbine as equal to the energy absorbed by the fan, we have:

$$(22)\qquad \rho_t 0.3075T_1\left[1-\left(\frac{p_z}{p_o}\right)0.226\right]=\frac{0.248T_z}{v}\left[\left(\frac{p_o}{p_z}\right)^{0.29}-1\right]$$

whence, finally, taking $x=\frac{p_o}{p_z}$:

$$(23)\qquad \rho=\rho_t\,\rho_v=0.81\,\frac{T_z}{T_1}\,\frac{x^{0.226}\,(x^{0.29}-1)}{x^{0.226}-1)}$$

Such is the general formula giving the required efficiency ρ. Taking as before:

$$x=\frac{1}{0.52}=1.923,\quad T_z=260,\quad T_1=973,$$

we find a required efficiency of 0.33 and, still assuming about 5% loss in the nozzle, we again find an efficiency of 0.35.

THE EFFICIENCY, ρ_t OF THE TURBINE.—In the single rotor turbine which we are considering, the gas is completely expanded in the nozzle and possesses, as we have seen, a kinetic energy equal to the heat it has lost, and it is this energy which is transformed into mechanical force in the mobile rotor. THE NET EFFICIENCY ρ_t, is the ratio of the power on the crankshaft to that contained by the gas which has supplied it.

Let ρ_i be the INTERNAL EFFICIENCY or efficiency proper of the fins and ρ_e the EXTERNAL EFFICIENCY corresponding to the loss by friction of the disk on the gas and to loss in the thrust bearings; we shall have:

(24) $$\rho_t = \rho_i \rho_e$$

ESTIMATE OF THE INTERNAL EFFICIENCY ρ_i.—We would recall the graphical method invented by M. Rateau, which consists in plotting on the same diagram the triangle of speeds at the inlet and outlet of the rotor, taking as modulus of the length scale the absolute velocity V of the gas at the outlet of the nozzle.

We will call: (See Fig. 394, p 883 of original text)

U, the rim speed of the fins.

V, the velocity of the fluid at the outlet of the nozzles.

α, the angle of injection of the fluid or outlet angle of the diffuser.

β, the outlet angle of the fins.

Intersect the rotor by a median cylinder whose axis is the axis of rotation and develop this cylinder; the extremity B of the fin system falls on the straight line XX'. The nozzles throw out the gas at a velocity V which we will plot in magnitude and direction from the straight line XX' with which it forms the angle of injection α. We obtain the vector AB which will represent the unit of length. On the other hand, the mobile rotor is given a driving speed AC = U which we have laid off on the line XX'. The relative velocity V_1 of the gas with respect to the rotor is, in magnitude, direction, and sense, the resultant of V and — U.

It is represented by the vector CB to which the mobile fin should be tangent in order that there may be no shock at the inlet. ACB is the triangle of speeds at the inlet.

The losses by friction and by eddying in the fin system have the sole effect of reducing the relative speed V_1 by about 20%; at the outlet this speed is only $V_2 = 0.8\ V_1$, the condition of tangency at the inlet being assumed to be realized.

From C now lead the vector CD equal to V_2 and meeting XX' at the known outlet angle β.

Then project DB in DE in a direction parallel to XX'. The value of the internal efficiency is:

(25) $$\rho_i = 2AC \times DE$$

the two lengths AC and DE being, as already said, estimated with V as unit of length.

For the turbine fitted on the Renault 300 h.p. engine, the speed of rotation provided for is 25,000 r.p.m. with a mean diameter of 0.158 m.

The rim speed U of the fins is thus 207 meters per second, and assuming for V the calculated value V = 558 meters/second, we fine $AC = \frac{207}{558} = 0.37$. The angle of injection α is 22° and the outlet angle β 35°. The diagram gives us DE = 0.95, from which finally, $\rho_i = 2 \times 0.37 \times 0.95 = 0.70$.

Taking an external efficiency ρ_e of 0.80, the net efficiency will be $\rho_t = \rho_i\ \rho_e = 0.56$. We may add that in the tests hitherto made we have not been able, owing to the care required to be taken of various organs, to keep a speed of 25,000 revolutions, and therefore the efficiency ρ_t was below the mark.

THE EFFICIENCY ρ_v OF THE CENTRIFUGAL FAN.

THE NET EFFICIENCY ρ_v of the centrifugal fan is the ratio of the power; employed on the crankshaft to that which would be required for obtaining compression pressure without loss and following the adiabatic cycle. In what follows we ignore the loss by radiation through the walls of the bodies of the apparatus.

We will call ρ_i THE INTERNAL EFFICIENCY corresponding to all losses resulting in additional heating of the air, and ρ_e THE EXTERNAL EFFICIENCY corresponding to leakages and friction in the thrust bearings.

The overall efficiency will therefore be:

(26) $$\rho_v = \rho_i \rho_e$$

THE TRUE HEATING OF THE AIR AND INTERNAL EFFICIENCY ρ_i.

Call:

T_z, the initial absolute temperature of the air, equal to the atmospheric temperature.

T_z, the initial pressure of the air, equal to atmospheric pressure.

T_o, the theoretic absolute temperature of the air after compression, corresponding to the adiabatic cycle.

T'_o, the true absolute temperature of the air after compression.

P_o, the pressure of the air after compression.

C = 0.24, the specific heat of the air at constant pressure.

$\gamma = 1, 4$, ratio of specific heats, therefore $\frac{\gamma - 1}{\gamma} = 0.29$.

As we have seen, if the cycle were rigorously adiabatic and without loss, the heating $\Theta_a = T_o - T_z$ would be such that:

(27) $$\frac{T_o}{T_z} = \left(\frac{P_o}{P_z}\right)^{0.29}$$

But by the principle of the conservation of energy, internal loss of energy is shown as an additional heating of the air, so that the true heating $\Theta_r = T'_o - T_z$ is greater than the theoretic adiabatic heating Θ_a:

(28) $$\Theta_r = \frac{\Theta_a}{\rho_i}$$

ρ_i being a coefficient less than unity which is none other, as we shall show further on, than the internal efficiency.

We shall thus have:

(29) $$T'_o - T_z = \frac{T_z}{\rho_i}\left[\left(\frac{P_o}{P_z}\right)^{0.29} - 1\right]$$

ρ_i is usually compressed between 0.60 and 0.70, according to measurements made on the bench, 0.60 should be assumed for aeroplane centrifugal fans.

In the case of a fan operating at an altitude of 5,000 meters, the surrounding temperature being —13° C., or $T_z = 260°$ absolute, and $\frac{P_o}{P_z}$ being equal to $\frac{1}{0.52}$, we obtain adiabatic heating $\Theta_a = 55°$, giving a final temperature of 42° C. The real heating, still ignoring loss by radiation through bodies, will be $\Theta_r = \frac{55}{0.60} = 92°$, giving a final temperature of 79° C.

The mechanical force supplied to the crankshaft PER KILOGRAM OF AIR and reduced by external losses, leakages, and friction in the thrust bearings, is utilized for three purposes:

1st. To produce compression of the air which, if it took place adiabatically without loss or radiation, would require an amount of energy in calories:

(30) $$Q' = C\ \Theta_a$$

This relation shows that the energy Q' is equivalent to the quantity of heat necessary for producing, at constant pressure, a rise in temperature equal to the adiabatic heating Θ_a.

2nd. To heat the air at CONSTANT PRESSURE by the quantity $\Theta_r - \Theta_a$, the difference between the real and adiabatic heating. ΘThis energy corresponds to the transformation into heat of all the internal losses of the apparatus; its value is:

(31) $$P = C(\Theta_r - \Theta_a)$$

3rd. To heat the exterior organs of the turbine by radiation and conduction.

If there is no cooling by injection or water circulation, the amount of energy thus lost is negligible as compared with those previously mentioned.

The total amount of energy supplied is therefore:

(32) $$Q' + P = C\ \Theta_a + C(\Theta_r - \Theta_a) = C\ \Theta_r,$$

and the internal efficiency is, by definition:

(33) $$\rho_i = \frac{Q'}{Q' + P} = \frac{\Theta_a}{\Theta_r}$$

THE INTERNAL EFFICIENCY ρ_i IS THUS CLEARLY EQUAL TO THE RATIO BETWEEN THE ADIABATIC HEATING Θ_a AND THE REAL HEATING Θ_r.

Lastly, introducing the coefficient of external efficiency, ρ_a, we see that the force supplied to the shaft per kilogram of air will be, in calories:

(34) $$E = \frac{C\ \Theta_a}{\rho_i \rho_e} = \frac{CT_z}{\rho_i \rho_e}\left[\left(\frac{P_o}{P_z}\right)^{0.29} - 1\right]$$

In the conditions of operating of the aeroplane fan, we may take $\rho_e = 0.92$ to 0.95.

We thus see that with an internal efficiency of 0.60, we may practically count on a net efficiency $\rho_v = \rho_i \rho_e = 0.55$.

Example of a Turbo-Compressor Adapted to An Engine

As an example we will take the Renault 300 H.P. 12 cylinders, 125 x 150, on which the Rateau turbo-compressor was fitted. As before, we will examine the question for an altitude of 5,000 meters, assuming for the turbine a net efficiency $\rho_t = 0.53$ and for the fan $\rho_v = 0.55$, that is, an overall efficiency of $\rho = \rho_t\rho_v = 0.29$.

We have seen that, under these conditions, we can re-establish in the carburetor a pressure of only 716 millimeters of mercury. The adiabatic rise of temperature given by formula (15) is $\Theta_a = 45.6°$, from which, with an internal efficiency of 0.60 for the centrifugal fan, a real heating

$$\Theta_r = \frac{45.6°}{0.60} = 76°.$$

The initial absolute temperature T_z of the air being 260° at 5,000 meters, its final real temperature will be $T'_o = 260 + 76 = 336$, that is, 63° C.

Assuming that there is no air radiator, the inlet air will thus have a pressure of 716 millimeters of mercury at the carburetor and an absolute temperature of 336°. Under these conditions of pressure and temperature, the weight of a liter of air is:

$$a = 1.293 \frac{716}{760} \times \frac{273}{336} = 0.99 \text{ gr.} \tag{35}$$

The total cylinder capacity of the engine is 22.1 liters; this is the geometrical volume taken in by suction in two revolutions. The speed of rotation being 1,600 revolutions, the geometrical volume taken in by suction per second is

$$\frac{22.1 \times 1{,}600}{2 \times 60} = 295 \text{ liters per second.}$$

We know that 1 gramme of air corresponds to $\frac{16}{15}$ grammes of carburetted mixture. Assuming a filling coefficient of 0.90, the output of exhaust gas per second will be:

$$\frac{16}{15} \times 0.90 \times 0.99 \times 295 = 280 \text{ grammes per second.}$$

We know that the power supplied to the turbine by an output of exhaust gas of 1 kilogram per second is 221 horsepower. The net efficiency of the turbine being 0.53, it will supply the crankshaft with:

$$221 \times 0.53 \times 0.280 = 33 \text{ horsepower.}$$

Steam tests made on the bench of the Rateau turbine fitted on the Renault engine now under consideration, have indicated a power on the crankshaft of about 40 horsepower.

We have already assumed that, per kilogram of carburetted gas, we should compress 1.034 kg. of air in order to make good the inevitable leakages in the manifolds. The centrifugal fan should therefore have an output of air per second of:

$$280 \times 1.034 = 290 \text{ grammes per second.}$$

Let us see whether, with 33 horsepower on the crankshaft, we really get a carburetor pressure of 716 millimeters of mercury. The atmospheric pressure at 5,000 meters being 407 millimeters of mercury, we shall have, for this rate of compression,

$$\frac{P_o}{P_z} = \frac{716}{407} = 1.758, \text{ whence } \left(\frac{P_o}{P_z}\right)^{0.29} = 1.1775.$$

By formula (34) we know that the energy in calories required on the fan shaft is:

$$E = \frac{CT_z}{v} \left[\left(\frac{P_o}{P_z}\right)^{0.29} - 1\right] \tag{36}$$

Substituting 0.24 for C, 260 for T_z, 0.55 for ρ_v and 1.1775 for $\left(\frac{P_o}{P_z}\right)^{0.29}$, we find E = 20.15 calories.

The horsepower required on the fan shaft for compressing 290 grammes of air per second will thus finally be:

$$20.15 \times 0.290 \times \frac{425}{75} = 33 \text{ h.p.}$$

CALCULATION OF THE SECTION OF THE DIFFUSER.—We assume that the weight of a liter of gas carburetted at O° and 760 millimeters is the same as for non-carburetted gas under the same conditions of temperature and pressure, which comes to the same thing as ignoring the molecular expansion caused by combustion.

We know that 16 grammes of carburetted mixture correspond to 15 grammes of air. Under these conditions, at O° and 760 mm., the weight of a liter of exhaust gas will be:

$$a_o = 1 \text{ gr } 293 \frac{16}{15} = 1.38 \text{ gr.}$$

The exhaust gas at the nozzle outlet is at an atmospheric pressure of 407 millimeters of mercury and at a temperature of $T_z = 840°$ absolute, whence a weight per liter:

$$a = 1.38 \frac{407}{760} \times \frac{273}{840} = 0.24 \text{ gr.}$$

The output at the exhaust being 280 grammes per second, we conclude that the output in liters per second at the outlet of the nozzle will be:

$$\frac{280}{0.24} = 1.165 \text{ liters per second.}$$

But we have found that the velocity of the gas at that instant is 558 meters per second. The section s of the diffuser must thus be, in square centimeters:

$$s = 10 \frac{1.165}{558} = 20.8 \text{ square centimeters.}$$

The tests on the Bréguet 14 A_2 were made with a diffuser having a section of 20 square centimeters.

ENGINE POWER.—The Renault engine in question gives 340 h.p. on the ground level at 1,600 revolutions. Without back pressure at the exhaust valve, we may assume that the power remains proportional to the inlet pressure; therefore, in the conditions of operation studied and without back pressure, it would be:

$$T = 340 \frac{716}{760} = 320 \text{ h.p.}$$

In reality, there is a back pressure at the exhaust of 760—716 = 44 millimeters of mercury, that is, 0.06 kg. per square centimeter, reducing this power, as we have seen, by about 1.2%, which gives a corrected horsepower of 316.

(To be continued)

400-Mile Radius for Coast Planes

The first giant Martin torpedo plane shipped to San Diego had ben followed by seven others.

This fleet which will operate out of the Naval Air Station at San Diego, will co-operate with the Pacific Fleet, but also will be utilized for strictly coast defense purposes, by land units.

In operating with the fleet, these huge torpedo planes can take off from the deck of a warship or sea-sled. Their cruising radius of 400 miles permits of several hundred miles of reconnaissance, and by means of their radio equipment accurate communication with the naval air bases can be maintained at all times. The planes, which can carry a useful load of 4,950 pounds, have by way of armament two Lewis machine guns, 450 pounds of bombs, in addition to a full-sized navy Whitehead torpedo, of 1,650 pounds.

In actual operation against a hostile fleet, the torpedo planes can fly 200 miles out to sea, single out their objectives, swoop down and launch their torpedoes at close range, thus practically insuring certain hits. The planes also are equipped with what are called flotation bags, which are inflated preparatory to landing on the water. These bags, which are capable of buoying the plane right side up, make it impossible for one of them to be lost at sea in case of accident, and further enable them to land beside their "mother ships," the aeroplane tenders, to be picked up for refuelling and renewed action.

Book Review

AERIAL TRANSPORT: By *G. Holt Thomas. Introduction by Viscount Northcliffe.* Quarto with 64 illustrations and 4 maps.

Written in an informal non-technical way a book which gives a clear uncolored statement of just what the commercial aircraft can do, and also—which is quite as important—what it cannot do. "What I seek above all in this book is to show the actual place of the aircraft in our general scheme of transport; the actual work it can do usefully, and the sort of things it would be foolish to ask it to do. Specially, too, I want to emphasize the point—which is indeed fundamental—that the aeroplane does not compete with existing forms of transport. It does something they cannot do. It supplements, not supplants them."—Foreword by the Author. Valuable maps of the recent English-Australian and trans-Atlantic flights, another showing the time-saving of the airway, the fourth, a map of the world, which shows what will be accomplished by 100 miles-an-hour aerial transport, as soon as routes are in regular operation. Price $12.50 postpaid. Copies can be obtained at *The Aeronautic Library, Inc.,* 299 Madison Ave., N. Y. City.

PREPARATION OF PLANE AND MOTOR FOR ALTITUDE FLIGHT

THE instructors of the Aeroplane and Motor Departments of the Air Service Mechanics' School, Kelly Field, are at present taking a refresher course in the form of tuning up motors and planes for passenger-carrying at high altitudes. One phase worthy of mention is the redesigning of a LePere biplane which will seat ten passengers and which should perform credibly at an altitude of twenty thousand feet or over. The LePere was chosen because of being slightly faster than a De Haviland. It has a different wing curve, permitting it to make greater speed. It is better streamlined, due to the fact that it has no nose radiator and to its design throughout and its cockpit has a larger capacity.

The LePere to be used will be unpainted. The wings will be newly covered, doped and valspared. The whole ship will be streamlined throughout and designs are now in the hands of the instructors in the aeroplane department for seating arrangements for ten passengers. A stock Liberty Motor will be used which tested 434 horse-power at the factory. As the performance of a Liberty Motor drops from 400 to about 74 horsepower at 25,000 feet, tuning up of the motor was necessary to increase the performance. The following changes have been made: Pistons and rings were all lapped into the cylinders. Intake valves and ports highly polished. The intake manifolds and carburetor bowls polished and shellaced to eliminate skin friction of the mixture. In addition to regular stacks reaching up through the cowl into the propeller stream, auxiliary stacks running horizontally from the rear of the radiator are fitted. These stacks have an opening, larger at the radiator, and are tapered to a comparatively small opening near the carburetor bowl, giving a forced draft. The auxiliary air intake ports are equipped with a mechanically adjusted shutter so that the forced air can be regulated. Valves and ignition are timed to within one-fourth of a degree. 175 compensator and a 165 main jet with a 36 choke are used. A nine-foot propeller with a seven foot seven and three-fourths inch pitch will be used.

With a supercharger a Liberty Motor develops 322 horsepower at 25,000 feet, but by tuning up a motor in the above manner, 2,000 to 2,100 r.p.m. will be obtained at sea level. It is believed that from 200 to 275 horsepower can be obtained from a motor without a superchanger at altitudes up to 25,000 feet.

The Le Pere biplane equipped with Liberty motor and supercharger for altitude flying

Dual Aerial Acrobatics

Charles Bragunier and W. C. May, each 18 years old, young men who are in training under Earl Daugherty at his field at Long Beach, Cal., for aviation work, delighted crowds at the beach with feats that have never before been accomplished. The two did acrobatic feats on the upper surface of a plane while the machine was piloted over Long Beach and its environs by Mr. Daugherty.

While high in the air both men rode on the tips, each at opposite ends. Then one of the men dropped down to the wing skid, while the other remained on top. Then one would stand on his head on the top plane, while the other hung on the landing gear by his knees. This stunt was reversed, the men below climbing up and the one above dropping below. Following this they ran back and forth across the top of the upper plane like two boys playing tag.

One landing was made at the aviation field with both men standing on the upper surface of the top plane, one at each tip. The machine ran evenly over the ground to a stop, so the men were not compelled to do more than a little balancing to maintain their upright position.

Seattle and Victoria Aerial Mail

Contract is being awarded today to Edward Hubbard of Seattle, Washington, for service by SEAPLANE for the transportation of the mails between Seattle, Washington, and Victoria, British Columbia, in close connection at Victoria with outgoing and incoming trans-Pacific mail steamers, but not exceeding an average of ten round trips a month, from October 15, 1920, to June 30, 1921, the amount of mail to be carried not to exceed 600 pounds a single trip each way. From investigation of conditions it was found that the seaplane service in a large majority of cases of incoming steamships would advance the delivery of mails at Seattle a full business day. In the dispatch of mails for connection with outgoing steamship a material amount of mail will be dispatched that otherwise would be held for the next trans-Pacific steamer. The exchange of mails between Seattle and Victoria will also be facilitated.

Van Schaack Assures Prompt Deliveries

At this time when transportation facilities of the country are inadequate to care for the abnormal demands put upon them, time is saved and much of the unnecessary delays are eliminated by having complete stocks readily accessible to the trade.

The Van Schaack Bros. Chemical Works, realizing this, have completed arrangements under which a full line of their products are being maintained in their Boston warehouse under the management of Mr. W. L. Holter with office at 8 Beacon Street.

This announcement will be especially interesting to Eastern tanners for it puts them in closer touch with one of their sources of supplies, assuring prompt and satisfactory service.

Van Schaack are independent manufacturers of Soluble Cotton, Patent Leather Solutions, Amyl Acetate, Cotton Solutions, Solvent Thinners, Ethyl Acetate and Refined Fusel Oil. Complete stocks are maintained at Chicago and Boston.

It is this regard for the interest of the trade that has been responsible in no small way for the remarkable growth of the Van Schaack business.

An Armless Air Student

Amongst the students being tutored at the Walter T. Varney Aviation School, San Francisco, Cal., is L. C. Thornton of Fresno, the only armless aviator in the world.

Mr. Thornton's right arm is taken off at the shoulder and from here the throttle is operated; his left arm is taken off below the elbow and the "stick" is operated by means of two hooks in the form of a hand. He has had absolutely no difficulty in learning to fly.

According to his instructor, Mr. S. E. Brush, he has shown particular aptitude for flying work and in the very near future he will go through his test for the pilot's license of the Aero Club of America, when the examining board will be composed of R. C. Irving of the Pacific Aero Club and H. H. Arnold of the Army Air Service.

Personal Par

Mr. A. A. Loeffler has recently been appointed by the Doehler Die-Casting Company as its Detroit representative, succeeding Mr. F. C. Seeger, who will now represent the company on the Pacific Coast, with headquarters in San Francisco.

THE AERIAL LEAGUE OF AMERICA'S STUPENDOUS CAMPAIGN TO POPULARIZE AERONAUTICS, ESTABLISH AIRPORTS AND EXTEND THE AERIAL MAIL SERVICE BY ORGANIZING A UNIT IN EVERY COMMUNITY, UNIVERSITY AND ORGANIZATION

HOW can I become connected with the Aeronautic Movement now, while it is in the pioneer, "ground floor" stage, when it is beginning to extend its usefulness to every branch of human endeavor, and the tremendous strides forward of aeronautics open exceptional possibilities for the employment of ingenuity, genius and skill and business opportunities as great as were opened by the railroad, automobile, telephone and telegraph industries?

There are problems of engineering as huge as were solved by the world's master builders; juridical questions to be decided as stupendously difficult as a statesman ever was called upon to settle; possibilities for the development of international relations greater than were ever conceived; problems of transportation to be solved by the application of aircraft as complex as have ever confronted economists; opportunities to gain distinction dazzling enough to satisfy the most ambitious.

No other branch of human endeavor affords such splendid opportunities to men—and women, too!—as the Aeronautic Movement affords in this pioneer, ground floor stage.

How can I participate in the development of aeronautics now, without actually becoming connected with the manufacturing and operating of aircraft, and become so intimately connected with aeronautics that I may be qualified to take advantage of opportunities to become a leader in this important branch of human endeavor?

To answer the above queries in a practical way, and leaving to the Aeronautic Movement the co-operation of those who are anxious to become actively connected with aeronautics, the Aerial League of America has started a plan to establish a Unit of the League in every community, large or small, university and industrial establishment in the United States and American "colonies" abroad.

It is a concrete, exceptionally practical plan which will enable progressive leaders of other lines of human endeavor in every community to take an active interest in aeronautics.

League's $5,000 Contest for Ideas and Designs for Aeroplanes Capable of Carrying from Twenty to Two Hundred Tons of Useful Load

Believing that the construction of aeroplanes capable of carrying from twenty to two hundred tons of useful load is possible now on account of recent discoveries in the construction of aeroplane wings and bodies and the general improvements in the construction of aeroplanes brought about by the world's huge expenditures in aircraft production during the war, which amounted to about five billion dollars, Mr. Henry Woodhouse, acting president of the Aerial League of America, has offered the sum of $5,000 to be awarded in prizes in a contest for ideas and designs for aeroplanes capable of carrying twenty, fifty, one hundred, one hundred and fifty and two hundred tons of useful load.

Mr. Woodhouse during the past ten years has forecasted every important achievement in aeronautics, including the practicability of building successful large, multi-motored aeroplanes, large dirigibles, flying across the Atlantic, using aircraft for transportation of mail and express, etc. His forecasts are always based upon knowledge of actual possibilities.

The Aerial League of America will have charge of the contest and in appointing a committee of experts to pass on the ideas and designs, will invite the Army, Navy and National Advisory Committee for Aeronautics, and Post Office Department to appoint their leading experts on this committee, so that the government will have the benefit of getting all the ideas and engineering data submitted in this contest.

Fifty-Ton Aeroplanes Within Two Years

Within two years there can and will, no doubt, be put in service aeroplanes capable of carrying fifty tons of useful load and dirigibles and aeroplanes capable of carrying tons of mail and express, and passengers, from New York to London in thirty hours. We have the engineers to design and build the aircraft and the world needs faster transportation and is ready to patronize aerial transportation.

The time is ripe for men to step in this marvellous branch of human endeavor and achieve here what the Vanderbilts, the Huntingtons, the Harrimans, Edison and Ford achieved in their respective branches of human endeavor—and the League by its nation-wide campaign may find and bring to the Aeronautic Movement future Vanderbilts, Huntingtons, Harrimans, Edison and Fords of the Air.

The world is waiting for great men to come who will be the great builder of airways, of trans-continental air trunk lines, of huge fleets of transatlantic airships, bridging the New World with the Old each day, and of brilliant lawyers to solve juridical problems created by the international nature of aerial navigation; of insurance and admiralty law experts to apply their knowledge to aeronautics and progressive men from every line of human endeavor to apply their knowledge to perfecting and extending the use of aircraft.

Aerial Transport Rates with Large Planes to Equal Railroad and Steamship Rates

The discoveries and improvements made also justify stating that an aeroplane constructed in accordance with the latest discoveries and improvements, carrying from twenty tons of useful load and up, can be operated so economically as to make it possible to equal railroad and first class steamship transportation rates in transportation of passengers and express matter, at the same time affording a quicker service.

What Communities and Organizations Can Gain

Aircraft are growing to enormous sizes and the construction of large aeroplanes and dirigibles is going to make the aeronautic industry more or less like the shipbuilding industry in character, excepting that aircraft can be built inland.

Communities that participate in and encourage the development of aeronautics are very likely to be repaid in the near future by being selected as airship construction centers, which will bring to these communities a lot of business and international and national distinction and prominence.

By participating in aeronautics a community, organization or individual will be taking an option on the business that is sure to come with the building of large aeroplanes and dirigibles, as well as the tens of thousands of small aeroplanes, for which a large demand has already been created, and for hundreds of other components, accessories and supplies needed in the construction and operation of aircraft and airports and for aerial navigation and air travel.

Aeroplanes Already in General Use

Here are a few of the uses to which aeroplanes have been put during the past year:

Commuting, taxi service, aerial express, flights for guests at hotels and summer resorts, campaigning, selecting land sites, oil field survey, carrying pay-rolls, serving summonses, delivering fresh fish, civic planning, food distribution, film delivery, transportation of Government Officials, laying out logging routes, mail carrying, forest fire patrol, aerial photography, making motion picture films, ranching, missionary work, commercial traveling, delivering clearance papers, fire surveys, carrying prisoners, visiting remote points, railroad survey, passport delivery, surveying for Chamber of Commerce reports of real estate and city property. Carrying samples of minerals and timber, aerial advertising, astronomical observation, emergency medical service, sheep and cattle herding, scouting for market-fish, soliciting towing business, surveys of docking, delivery of perishable products, machine-part delivery, Polar exploration, baseball transportation, ambulance work, wheatfield survey, air exploration, boundary patrol, real estate survey, carrying precious ore, quick delivery of merchandise, fur-carrying, hospital transfer work, delivering newspapers, railway terminal surveys, Southern plantation travel, aerial ferrying, life guard work, carrying newspaper reporters, forestry survey, delivering mail at sea, delivering delayed documents, bombing ice jams, locating schools of fish, detecting cattle rustlers, etc., etc., etc.

Write the Aerial League for Further Information

The following plans for the organization of Units of the Aerial League of America are admirable for their completeness and far-readingness. **Further information about membership rates, membership privileges can be obtained by writing to the Secretary: Aerial League of America, 280 Madison Avenue, New York City, N. Y.**

ORGANIZATION PLAN FOR THE UNITS OF THE AERIAL LEAGUE OF AMERICA

Units will adopt the name of the community, university, institution or organization where they are organized. Officials and members of Units are members of the Aerial League of America and are entitled to all the privileges of membership in the Aerial League of America, in addition to which they assume the name of the Unit, as for instance, the chairman of the Boston Unit is designated as "The chairman of the Boston Unit of the Aerial League of America," etc.

Name of Unit...

Name of Chairman of Unit...

Address of Chairman..

Address of Meeting Place and Aeronautic Library..............................

What day of the week or month are regular meetings of the Unit to be held?..................

On what days and hours can members of the Unit call at Unit's Aeronautic Library to borrow or read books and periodicals? ....

Names and Address of Vice-Chairman and Secretary of the Unit:

	Name	**Address**
First Vice-Chairman		
Second Vice-Chairman		
Third Vice-Chairman		
Fourth Vice-Chairman		
Executive Secretary		

Regular Meetings of the Members of the Unit: The Unit shall hold regular weekly, semi-monthly or monthly meetings on days and hours set by the Executive Committee of the Unit, which shall so arrange its schedule as to insure having at each meeting the report of one or more of the Committees of the Unit, with discussions of the subjects presented. As the Committees make periodical reports on the progress of the branches of aronautics of which they are in charge and the dates for presenting their reports is to be fixed by the Executive Committee, in the event that weekly or monthly meetings of the Unit are held, there will be one or more Committee reports presented and discussed at each meeting.

The Executive Committee may, at its discretion, invite authorities and officials to attend the meetings as the guests of the Unit. What other cities throughout the world are doing aeronautically will interest the Mayor, the City Commissioners, the Postmaster, the Judges, the Sheriff, the Chief of Police, the City Planning Commission, the Station Master and other officials; and the progress in aeronautic insurance will interest the insurance experts, the medical aspects of aeronautics will interest the progressive M.D.s, the introduction of aircraft and air features in films, plays, and aeronautic songs, poetry, literature and art will be of interest to many people, the technical development of aircraft and motors will interest engineers, the equipment for and problems of night flying will interest electrical experts, the evolution of aerial laws will interest lawyers, etc., etc.

NAMES AND FUNCTIONS OF COMMITTEES

(1) **Executive Committee:** The Chairman of the Unit, who has been appointed by the President of the Aerial League of America, shall be the Chairman of the Executive Committee of the Unit, which Committee includes the First, Second, Third, and Fourth Vice-Chairmen, and may be increased at the discretion of the Chairman of the Executive Committee. The Executive Committee shall have charge of all affairs of the Unit. The Chairman of the Executive Committee shall be ex-officio member of all committees.

The Executive Committee shall appoint the Chairmen of all committees, which shall consist of a Chairman, a Vice-Chairman and such number of additional members, and to have such powers as the Executive Committee may from time to time determine.

The Executive Committee shall meet at the call of the Chairman and shall keep the minutes of its proceedings, make a report at each annual meeting and perform such other duties as by resolution it may from time to time adopt.

The committees of the Unit shall perform the duties herewith outlined and such other duties as by resolution the Executive Committee may direct.

(2) **Board of Trustees:** The Executive Committee may, at its discretion, elect a Board of Trustees, composed entirely of members who shall have paid or pledged $500 or over to the objects of the Unit. Said trustees will become members of the Executive Committee of the Unit upon payment of their pledges or may be elected "patron" members.

(3) **Honorary Chairman, Vice-Chairman and Members:** The Executive Committee may also elect an Honorary Chairman, six Honorary Vice-Chairmen and six Honorary Members, who shall be persons of either sex who have attained eminence through the promotion of aeronautics or who shall have made important contributions toward the support, expansion of activities and success of the Unit, or who hold office in federal, state, city, or civil organizations.

(4) **Finance Committee:** The Finance Committee shall have charge of the finances of the Unit, subject to instructions from the Executive Committee.

Name of Chairman...

Address ....

(5) **Membership Committee:** The Membership Committee shall have charge of the finances of the Unit, subject to instructions from the Executive Committee.

Name of Chairman...

Address ....

(6) **Aeronautic Library Committee:** It shall be the duty of this Committee to maintain an up-to-date Aeronautic Library, equipped with the necessary books and periodicals to supply the chairmen and members of the other committees with the information necessary to make their reports. The Aeronautic Library of the Unit may be located at the headquarters of the Unit, which may be in the office or home of one of the officials or in one of the Clubs. The Executive Committee of the Unit may decide to turn the Aeronautic Library into a source of revenue by selling books, periodicals, maps, and aeronautic novelties and conducting a circulating aeronautic library, charging fees for loaning books, the proceeds from which will go to the Unit. In such a case the Aeronautic Library may be established in a shop or office, whichever the Executive Committee may decide. Plans for establishing and operating an aeronautic library at a profit can be obtained from the Aeronautic Library, Inc., 299 Madison Avenue, New York City.

A well operated Aeronautic Library costing little over $100 will make the Library a center of aeronautic activities, attract many people and do much to increase the membership of the Unit and to make the Unit the advisory body for people interested in aeronautics in your community.

Name of Chairman..

Address ....

(7) **Military Aeronautic Committee** shall follow the progress of the application of aircraft for military purposes throughout the world and report periodically on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(8) **Naval Aeronautics Committee** shall follow the progress of the application of aircraft for naval purposes throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(9) **Aerial Mail Committee** shall prepare plans for establishing aerial mail routes to the community represented by the Unit and shall follow the progress of the application of aircraft for aerial mail carrying throughout the world, and report periodically on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(10) **Air Travel and Transportation Committee** shall follow the progress of the application of aircraft for the purpose of air travel and transportation throughout the world and report periodically on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(11) **Airports and Emergency Landing Committee** shall make plans for establishing an airport and emergency landing places in the community and follow the progress made in establishing airports and landing places throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(12) **Aerial Touring Committee** shall follow the progress of the application of aircraft for the purpose of aerial touring throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(13) **Marine Flying Committee** shall follow the progress of marine flying throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(14) **Aerial Coast Guard and Life Saving Service Committee** shall follow the progress made in the application of aircraft for coast guard and life saving purposes throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(15) **Airship (Dirigible) Committee** shall follow the progress made in the construction and operation of airships (dirigibles) throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(16) **Aeroplane Improvements Committee** shall follow the progress made in the technical improvements of aircraft throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(17) **Aero Engines Committee** shall follow the progress made in improving aero engines throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(18) **Airways and Air Routes Committee** shall follow the progress made in the establishing of airways and air routes throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(19) **Aeronautic Maps Committee** shall prepare maps of the locality, showing all open places affording runways of from 400 feet upward for aircraft, and shall follow the progress in the making of aeronautic maps throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(20) **Aerial Police and Public Safety Committee** shall assist the authorities in organizing aerial police reserves and enforcing measures necessary for public safety where aircraft are operated; and shall follow the progress made in the organization of aerial police forces and measures adopted for public safety throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(21) **Night Flying Committee** shall follow the progress made in night flying throughout the world, the lighting equipment adopted for aircraft and airports in different countries, problems to be solved, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(22) **Aerial Laws and Regulations Committee** shall follow the progress in making aerial laws and regulations for aerial navigation throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(23) **Aeronautic City Planning Committee** shall follow the progress in employing aircraft to assist in city planning throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(24) **Practical Uses of Aircraft Committee** shall follow the progress made in the use of aircraft for commercial and general utilitarian purposes throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(25) **Aeronautic Insurance Committee** shall follow the developments that take place in the field of aeronautic insurance, methods employed to define risks, premiums charged, methods of adjusting claims, etc., throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(26) **Air Medical Standards Committee** shall follow the progress made in the establishing of air medical standards and increase of knowledge of the medical aspects of flying throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(27) **Aero Photography Committee** shall follow the progress made in the application of aero photography for city planning, surveying and mapping, and improvements in aeronautic photographic equipment throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(28) **Aerial Exploration and Surveying Committee** shall follow the progress made in the application of aircraft for exploration and surveying throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(29) **Aeronautic Instruments Committee** shall follow the progress made throughout the world in producing and improving instruments needed for aerial navigation and to improve the operation of aircraft, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(30) **Aeronautic Literature Committee** shall follow the growth of aeronautic literature as a whole, including the introduction of aeronautic topics in contemporary fiction and poetry throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(31) **Aeronautic Art Committee** shall follow the progress of aeronautic subjects in drawings, painting and sculpture throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(32) **Aeronautic Music and Drama Committee** shall follow the growth of aeronautics in music, drama, motion pictures, and plays throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(33) **Aero-Astronomy Committee** shall follow the application of aircraft to the study of astronomy throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(34) **Aircraft Advertising Committee** shall follow the growth of the use of aircraft for advertising purposes throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(35) **Contest Committee** shall have charge of conducting all the contests organized by the Unit or by other organizations, in which the Unit participates, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(36) **Public Education Committee** shall have charge of issuing statements and reports for publication, subject to instructions from the Executive Committee.

Name of Chairman..

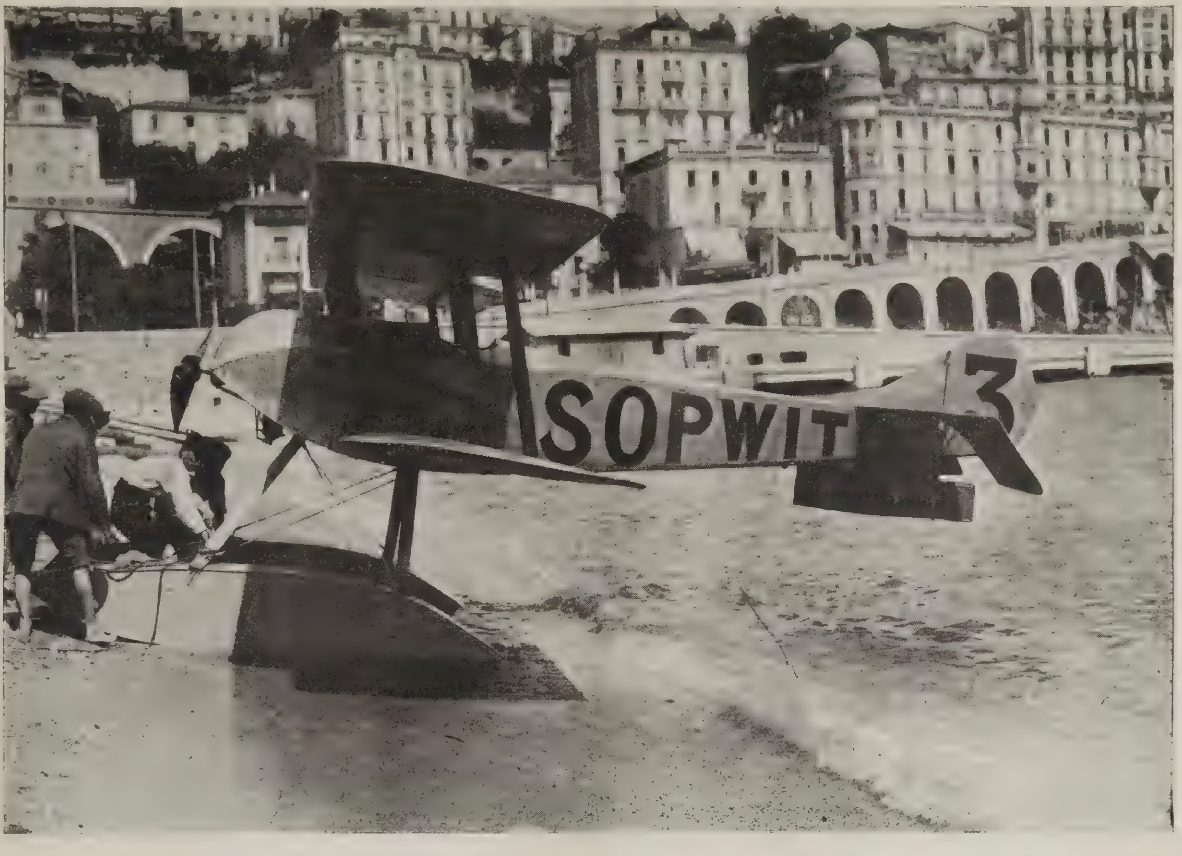
Address ....

(37) **Entertainment Committee** shall have charge of arranging the entertainments and meetings of the Unit, subject to the instructions of the Executive Committee.

Name of Chairman..

Address ....

For further information write to the Secretary, Aerial League of America, 280 Madison Avenue, New York City.



The Sopwith Hydro-biplane which won the International Seaplane Trophy Contest in 1914

THE SCHNEIDER INTERNATIONAL MARINE FLYING TROPHY CONTEST

IT is unfortunate that the U. S., the country which evolved the first successful seaplane and was responsible for the creation of the International Seaplane trophy did not participate in this year's contests, which is to be held at Venice, Italy, as AERIAL AGE goes to press, under the auspices of the Aero Club d'Italia, account of which will be given in future issues of AERIAL AGE.

This trophy and the annual prizes of $5,000 were offered by Mr. Jacques Schneider, French sportsman and steel magnate, at the suggestion of Mr. Henry Woodhouse. Mr. Woodhouse went to Chicago with Mr. Schneider in 1912, for the Gordon Bennett Aviation Trophy Contest and forecasted to Mr. Schneider the great developments to be expected in marine flying and suggested to his friend the offer of an international Marine Flying Trophy. Mr. Schneider welcomed the suggestion and offered the trophy with three annual prizes of $5,000 each.

The contest for 1913 was held in the Mediterranean Sea off Monaco on April 16th, 1913. It was won by Maurice Prévost flying a Dépérdussin hydroaeroplane. The one American competitor, Mr. Charles Terres Weymann, was prevented from winning when his lubricating oil was exhausted near the end of his course, he being at that time well in the lead.

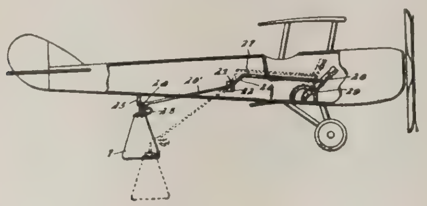
The contest for 1914 was held at the same place as that of 1913, on the 20th day of April. It was won by C. Howard Pixton, a British aviator, flying a Sopwith hydro-biplane. The two American entrants, William Thaw and Charles T. Weymann, together with R. Garros (France) and V. Stoeffler (Germany), did not start. Nine entries were made by five countries.

Subsequent contests have not been htld because of the European conflict until last year, when the contest was held at Bournemouth on September 10, 1919. There were eight entries, British, French and Italian and the Italian fannells, flying a Savoia flying boat, made the best performance but was disqualified on a technicality. The privilege of holding this year's contest was, however, granted to the Aero Club of Italy, which arranged the contest to take place at Venice.

The Savoia flying boat which made the best performance in 1919

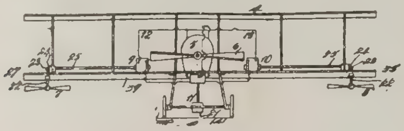
RECENT AERO PATENTS

1,338,970. AERIAL-MAIL EXCHANGE. William H. Burton and Claud J. Wilkerson, East St. Louis, Ill. Filed Feb. 1, 1919. Serial No. 274,435. 6 Claims. (Cl. 258—1.)



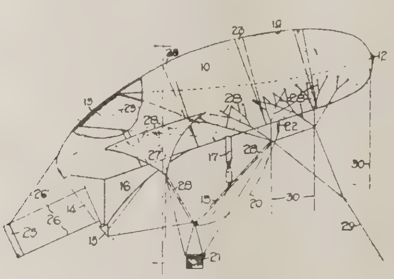
1. The combination with an aircraft, of a mail catching and delivering arm pivotally attached thereto beneath the fuselage, a spring detent for holding said arm in bag holding position, a rock shaft to which said arm is fastened, and a manually operable lever for turning said rock shaft.

1,340,214. AEROPLANE-STABILIZER. Anthony Chiarelli, New York, N. Y., Filed Mar. 2, 1918. Serial No. 219,955. 2 Claims. (Cl. 244—25.)



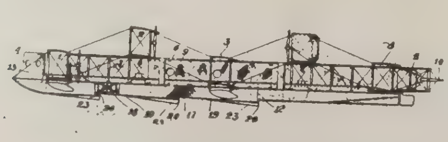
1. In combination with an aeroplane, a controller box pivotally secured thereto, a series of resistances located at each side of the box, a pendulum pivotally connected to said box intermediate said resistances, arms radiating from the pendulum one on each side thereof and extending toward said resistances, a brush carried by each arm and arranged to contact with said resistances, a motor in circuit with each series of resistances, and a stabilizing propeller actuated by each motor.

1,341,248. KITE-BALLOON. Ralph H. Upson, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio, a Corporation of Ohio. Filed Nov. 9, 1916. Serial No. 130,381. 11 Claims. (Cl. 244—4.)



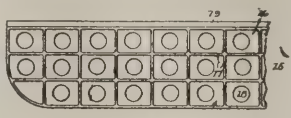
2. In a balloon, a pair of separate balloon bodies longitudinally mated to form a composite balloon envelop; a separate ballonnet for each balloon body; a separate filling neck for each balloon body; and a basket and tail cup conjointly supported by and between said balloon bodies.

1,341,029. AEROPLANE. Charles R. Whitteman, Richmond, N. Y. Filed Feb. 24, 1915. Serial No. 10,200. 10 Claims. (Cl. 244—12.)



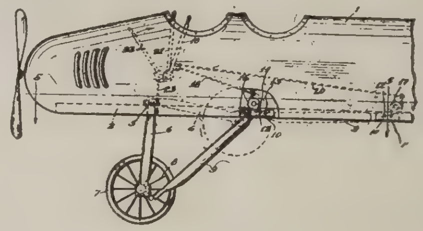
1. An aeroplane having more than two longitudinally separated supporting units, and comprising fixed planes wherein each rearward unit is positioned relatively to the next forward unit just beyond the area occupied by the non-supporting disturbed air current which leaves said forward unit; the factors of chord, camber and angle of said forward unit, in normal flight of the aeroplane, determining the extent of said disturbed area; whereby said rearward unit meets approximately the same supporting pressure as said forward unit.

1,332,930. AIRCRAFT CONSTRUCTION. Joseph A. Steinmetz, Philadelphia, Pa. Filed Jan. 8, 1918. Serial No. 210,888. 4 Claims. (Cl. 244—31.)



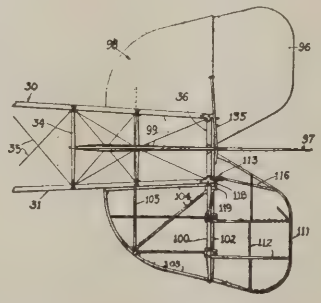
1. In a supporting plane for aircraft, the combination with a pressed pulp sheet having on its face a series of integral ribs, of an approximately parallel sheet secured to the edges of said ribs, substantially as set forth.

1,333,329. FOLDING LANDING-GEAR FOR AEROPLANES. Morton Halbert Megaffin, Edgewood, Iowa. Filed Sept. 15, 1919. Serial No. 323,708. 1 Claim. (Cl. 244—2.)



The combination with an aeroplane of pivoted hangers carried thereby, wheels secured to said hangers, struts hinged to the bottom portion of said hangers, slidable blocks connected with the upper ends of said struts, frame members provided with grooves arranged to receive said blocks, a rigid link connected at one end to the said hangers and at the other end to a lever in the cock pit of the aeroplane for swinging the lower end of said hangers upwardly, thereby sliding said blocks in the grooves in said frame members, pivoted locking members connected by rigid links to levers in the cock pit of the aeroplane for locking said blocks at the ends of the line of travel in said grooves and for unlocking the said blocks at will to permit the lower ends of said hangers to be swung downwardly by the force of gravity.

1,336,405. AIRPLANE. Henry Kleckler, Hempstead, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, a Corporation of New York. Original application filed Feb. 8, 1917. Serial No. 147,414. Divided and this application filed May 31, 1918. Serial No. 237,437. 7 Claims. (Cl. 244—29.)



2. In an airplane, a body, a directional control surface, hinges for said surface secured to said body, horns for said surface located intermediate the planes of the sides of said body, and a means commonly reinforcing both the horn and hinge connections.

NAVAL *and* MILITARY AERONAUTICS

American Aviators On Guard at Rhine

The American forces in Germany will have an aviation unit in operation within the next few weeks. The newest type of United States Army aeroplanes which have been developed recently in America have been shipped to Germany, and a group of aviators already has arrived. The unit will become an active part of the Rhine forces as soon as final arrangements have been completed.

The American forces in Germany have been without an aviation arm since last spring, when the forces were reduced to 15,000 or 16,000 men. Brig.-Gen. H. T. Allen, Commander-in-Chief of the American Army of Occupation, has repeatedly urged that the Rhine army should have its own aviation service, and the decision of the War Department to include a complete unit is the result of Gen. Allen's representation.

Educational Classes at March Field Well Under Way

March Field has retained her educational title. With 95 per cent of the enlisted personnel attending educational and vocational classes this school leads all army camps in the Western Department according to a report from Commanding General, Major-General Hunter Liggett.

Because of this record and by way of encouraging this work an additional allotment of $8,200 has been granted. Additional allotments for recreational, athletic and morale training activities are expected during September.

Leaps 20,900 Feet, Parachute Record

Washington.—The most thrilling parachute jump reported to the Army Air Service was made recently by Lieut. A. G. Hamilton, who fell 20,900 feet in twelve minutes, establishing a new altitude record for "chutes."

Lieutenant Hamilton jumped from a La Pere plane piloted by Lieut. P. H. Downes, at Carlstrom Field, Arcadia, Fla. A heavy layer of cloud was encountered at 4,000 feet, a lighter cloud formation at 10,000 feet and mist at 15,000 feet. The previous "high jump" record was 19,800 feet, made by Lieutenant Krug in Texas.

As soon as he discovered something wrong with his motor, Lieutenant Downes maneuvered for the best possible position for Lieutenant Hamilton to jump off. As Hamilton hopped into space he caught a glimpse of the earth, mistaking it for Door Field. Hamilton allowed two seconds for clearance, then pulled the wire which was supposed to release a pilot chute. The chute springs open automatically and, catching the rush of air, draws the main chute from the back of the operator. Hamilton had fallen an estimated distance of 2,000 feet before the big parachute opened. Hamilton then discovered that the springs which close the air vent at the top were broken.

When he approached the earth he found himself over a wooded area. Climbing the rigging, he pulled an edge of the parachute downward and was saved by a rope catching on the branches of the trees.

Army Airship Schooling

Whenever the public hear of, or speak of, the Army Air Service, they immediately visualize spectacular aeroplanes, while balloons and airships very rarely are given a thought, as they are generally believed to be a very small part of the army. As a matter of fact, lighter-than-air machines comprise one of the most important phases of army aviation.

Right now the Army Air Service is offering to the young men of the country an opportunity for peace-time education which is unique in several respects. Two hundred and fifty cadets have been authorized for training as Balloon and Airship Reserve Officers. This training is open to unmarried men between twenty and twenty-seven years of age possessing high school education or its equivalent, who can pass the regular army physical examination for enlistment, and the physical tests required of flying officers.

The successful applicant is enlisted on a cadet status at the rate of pay of seventy-five ($75.00) dollars per month and ration allowance of a dollar a day, and is sent to an Air Service School for training as a Balloon Observer. This school is located at Ross Field, near Los Angeles, California, where facilities are provided for this training under most ideal conditions. The cadet is given a ten-months' course in military training and balloon observation which course includes the handling of the balloon in all its phases and observation from the balloon basket. In addition, the cadet is trained as a free balloon pilot and is thoroughly grounded in artillery firing.

Young men who are interested in this training should make application to the Chief of Air Service, Washington, D. C., specifying that they desire balloon and airship training. They will then be given detailed instruction as to the steps necessary to be taken.

Navy Balloon Hits Mountain

Los Angeles.—The Navy dirigible balloon C-6 became lost in a dense fog Sept. 30 while sailing from San Diego to San Pedro to take part in fleet maneuvers and crashed into a mountain peak in the outskirts of Hollywood, spilling the car and its crew of five men about 200 feet down Laurel Canyon. Four men were hurt.

The injured were Lieutenant Gordon G. McDonald, pilot, both ankles broken and badly bruised; Lieutenant L. A. Pope, back wrenched; Eugene Fry, chief machinist's mate, cuts and bruises; Ralph Hartman, Chief Quartermaster, cuts and bruises.

According to Lieutenant McDonald, the dirigible ran into a fog at an elevation of about 1,800 feet. The crew became confused and descended to sight landmarks. Lieutenant McDonald said he recognized Hollywood and headed for San Pedro. Then the peak appeared and the pilot was unable to gain enough elevation to clear it.

The balloon crashed into the mountain top and a huge hole was torn in the gas bag. The impact rended the car from the cables attaching it to the bag and it crashed down the mountainside about 200 feet before it lodged, the shock rendering its occupants helpless.

The C-6 was 200 feet long and contained 170,000 cubic feet of gas, which escaped without exploding when the bag was pierced.

Prohibition's Fourth Dimension

Major A. V. Dalrymple, prohibition commissioner of the central district, in attendance at the State Convention of Police Chiefs, held at Mt. Clemens, announced the innovation of a pursuit plane to hunt down river bootleggers along the international boundary. This plane will be flown by a former army flier.

Army's Largest Dirigible Flies to Richmond and Return

Residents of Richmond, Va., were treated to the spectacle of a large army dirigible flying over their city recently, when the Zodiac, the largest airship in the United States, under the command of Captain Dale Mabry, flew over their city. The start was made at Langley Field, Va., and the entire trip was flown without trouble. Some very valuable photographs were made from the airship, including views of strategic points in and around Richmond. During the entire trip the Zodiac was in constant touch by radio telephone and radio telegraph with the Langley Field radio station.

It is no uncommon sight now at the balloon and airship center, Langley Field, Va., to see the three army airships in the air at once, making practice flights to train and qualify officers as airship pilots. The A-4, C-2, and the Zodiac are frequently in the air together and make frequent practice flight to surrounding points of interest. Occasionally the navy airship stationed at Norfolk pays a friendly visit to the airship center and on one occasion all four dirigibles were to be seen in the air at the same time. All of the army dirigibles are equipped with radio telephone by means of which the dirigible commanders are in constant communication with the ground, and with one another.

Three large dirigibles of the Army Air Service made a very successful flight in formation at Langley Field, Va. Taking the air at eight A. M., for two hours the Zodiac, A-4, and C-2, maneuvered back and forth across the sky in formation, file formation, and front formation, at the will of the commander. The radio telephone was used for communications between the dirigibles. Major William N. Hensley, Jr., commanding officer of Langley Field, was a passenger on the Zodiac.

Schroeder to Resign

Dayton, O.—Captain R. W. Schroeder, holder of the world's altitude record, will retire from the air service as soon as he returns from France, it was announced at McCook Field. He wll go into business.

FOREIGN NEWS

The Bleriot Mammoth Flies

Lieut. Casale last week put the Bleriot Mammoth through some tests for the French Section Technique Aeronautique. It is stated to have flown for 40 minutes, to have risen 2,000 meters in a qaurter of an hour, and attained a speed of 150 kilometers per hour at an altitude of 1,000 meters.

To Make a Map of Calcutta

The Calcutta Improvement Board is seriously considering the question of arranging with a firm for the use of a Handley Page machine to enable an accurate map to be made of the city and its surroundings.

Help for Chile's Air Force

About 2,000,000 pesos (£101,000 approximately) has been raised in Chile by popular subscription for the purchase of aeroplanes for the army and navy, and representatives of all nationalities subscribed.

The Next Paris Salon

It has now been officially announced that in accordance with the wishes of the French manufacturers, who will not have new models ready in time, there will be no Salon de l'Aeronautique in the Grand Palais this year. The next Salon will be held either towards the end of 1921 or at the beginning of 1922.

The L 72 Renamed

The French naval authorities have decided that the L72 recently delivered to France by Germany is to be known as the D.R.1, indicating that it is the first rigid dirigible belonging to the French Navy.

Brussels-Paris Fare Reduced

From September 4 the fares for flights between Paris and Brussels have been substantially reduced; they are now: Single journey 300 francs, return 450 francs, these charges including transport between the centre of the city and the aerodrome at each end.

Turin Bombarded by Leaflets

In connection with the strike of metal workers in Italy, two aeroplanes flew over Turin on September 5, distributing propaganda leaflets, but they disappeared on the arrival of military aeroplanes.

A Lapland Air Service

Advices received by Hanley Page, Ltd., state that the most northerly Air Service in the World has been established between Porjus in Sweden and Suorvajaure in Lapland. At Porjus is situated the great Swedish electrical power station which provides the motive power for the Swedish electrical railway system. Suorvajaure lies about 60 miles to the North-West of Porjus and is a deserted spot without any means of communication other than the regular Air Service which has now been established. It is, however, important in connection with its water power which is now being developed. The aircraft not only carry the mails and passengers between the two places, but materials required by the contractors engaged in erecting the power plant.

Aviation Progress in Brazil

The demonstrations given by the Handley Page Mission in Brazil have resulted in the contract for aerial passenger services from Rio de Janeiro to S. Paulo and this is shortly to be extended to Pernambuco. Commander Delamare of the Brazilian Navy has charge of a N. T. flying boat which has been giving excellent results.

The Aero Club of Brazil have invited the Handley Page Mission to use their extensive aerodrome at Ilha do Governador, and two hangars have been erected there by the Mission. Incidentally, the club has acquired two aeroplanes for their own use from Handley Page, Ltd.

The Air-Port of Bremen

The Bremen citizens, having exhibited businesslike foresight in erecting aerodrome buildings at a cost of 120,000 marks, which they promptly leased to the Lloyd Luft-Dienst and Sablatnig Gesellschaft, and are earning 10 per cent interest on their investment, are now turning their attention to a more important venture. Since May last a project has been on foot to establish an air-port at Bremen on a huge scale, with extensive aerodrome, custom house, hangars, repairing shops, signaling apparatus and every improvement that German ingenuity can devise to facilitate aerial navigation. It is reported that 11,000,000 marks have been invested for this ambitious scheme, which, according to all appearances, will shortly become a *"fait accompli."* This will place Bremen in a far better position than Hamburg, which has shown so little interest in the commercial side of aviation that the Hamburgers are themselves bginning to complain bitterly of the lack of enterprise on the part of their city fathers.

London-Copenhagen Record Flight

The record of six hours five minutes in flying from London to Copenhagen was established by Lieut. Vaughan Fowler on August 9th in a D.H.-9 aeroplane with a mechanic. The machine left the Handley Page Aerodrome at Cricklewood at 12:10 p. m., reaching Amsterdam at 2:15 p. m. At 3:45 p. m. it flew for Copenhagen, where it arrived safely four hours later. The machine is intended for the North West European Aerial Mail and Passenger Service, which has been organized by the co-operation of English, Dutch, German, Danish and Swedish aerial transport companies. This is the first instance of a German service being linked up with a direct aerial service to London, and passengers can now be booked through to Berlin via Bremen and Hamburg. The agencies of the Hamburg-America Line book passengers and freight throughout Germany for the new service, which is flown via Malmö-Warnemünde-Hamburg-Bremen-Amsterdam, the Handley Page Transport, Ltd., carrying passengers from Amsterdam to London. The Copenhagen-London service is flown on Tuesdays, Thursdays and Sundays. The return journeys are on Mondays, Wednesdays and Fridays.

French Aviation

It is obvious from a recent statement in the French Parliament by the Assistant Secretary of State for Aviation that the French Government is fully alive to the importance of the subject. He pointed out that the air-way from Calais to Paris and Nice would not be limited merely to French interests, but would be looked upon as a French section of the highway from Western Europe to Africa and Asia. He is entirely in agreement with the need of encouraging aerial services between points which are badly served by railways and sea, although he emphasized the fact that in the initial stages it will be necessary to take into consideration the linking up of districts where exists a minimum of traffic suitable for aerial transport. By way of comparison he directed attention to the rapid progress which has taken place in the aerial service between Paris and London, due to the general movement of passengers and business between the two cities, thus rendering it easy to find travelers and urgent freight, while, on the other hand, the service at present between Algiers and Timbuctoo would be far more difficult of realization. At the same time he made it clear that the French Ministry of Aviation would not lose sight of their foreign possessions and colonies. Indeed, he went so far as to declare that the organization of international airways via France was very nearly complete and that special efforts would be made next year toward Northern Africa and gradually afterward to the whole of their possessions overseas. In the course of his statement he gave some interesting figures in regard to the cost of the French portion of the Paris-London service. The total cost for upkeep of aerodromes, hangars, repairing shops, meteorological and wireless installations is estimated at 20,000 francs per kilometre (⅝ mile), as against the cost of 500,000 francs per kilometre of a single line of railway.

According to the experience acquired by the French Government in regard to the Paris-London service, the Assistant Secretary of State expressed the opinion that in future the total cost of organizing an aerial service would be less than 10,000 francs per kilometre. On the other hand, he emphasized the difficulties due to present heavy charges on flying plant, the French calculation of the life of an aeroplane being a flight of 200 hours, or, in figures, about frs. 3.50 per kilometre, to be added to the total cost of the service. On this point he was, however, of opinion that it would soon be reduced, as even taking into consideration the marvelous results that had been attained, one could only consider the technical manufacturing branch as being still in its infancy, and many improvements were on the way.

British Imperial College to Teach Aviation

A department of aeronautics has been established by the Imperial College in South Kensington to give effect to the scheme proposed by the Committee on Education and Research in Aeronautics, which held that the Imperial College should become the central school for the study of aeronautical science. The school is administered by an advisory committee of twelve members, with Sir Arthur Acland as chairman. Members of the committee represent the Air Ministry, the Imperial College, the Aeronautical Research Committee, the University of Cambridge, the Royal Aeronautical Society and the Society of British Aircraft Constructors.

A comprehensive scheme of instruction and training, mainly postgraduate in character, has been arranged for the next session, which begins in October. It includes aeronautical engineering, meteoology and navigation. With the co-operation of the Air Ministry, a staff of distinguished experts has been engaged. Courses of lectures will be given dealing with airships and with navigation, while there will be special instruction in air-cooled engines, high-compression engines, instruments, wireless telegraphy and similar subjects.

It has been arranged that students of aviation will carry out a part of their practical training in one of the Government stations.

The Danish Aerial Navigation Company

Some of the D.H.9s bought by the Danish Aerial Navigation Co. have now arrived by air from London with passengers, piloted by Messrs. Faber and Fowler, and are to be engaged on hte three-weekly service, the first flights of which were meanwhile carried out by A.E.G. and L.V.G. D.14 aircraft along the German coast. On the Copenhagen-London service starts to London are made on Tuesday, Thursday, and Sunday, from London on Monday, Wednesday, and Friday.

The time-table and fares are as follows:—

Arrival Copenhagen 7 p.m.—H1.
Arrival Malmö 9 a.m.. Fare 80 Sw. crowns.
Arrival Warnemünde 11 a.m. Fare 220 Sw. crowns.
Arrival Berlin (daily) 1 p.m. Fare 950 mark.
Leavev Warnemünde 11.30 a.m.
Leave Hamburg 2.30 p.m. Fare 1,200 mark.
Leave Bremen 4 p.m. Fare 600 mark.
Arrival Amsterdam 7 p.m. Fare 2,200 mark.

Amsterdam-London and London-Amsterdam twice daily and according to demand:—

Leave Amsterdam 9 a.m.; arrival Bremen 12.30 p.m.
Leave Bremen 12.45 p.m.; leave Hamburg 2 p.m.
Bremen. Arrival Berlin 3 p.m. Sablatnig service. Fare 2,000 mark.
Leave Warnemünde 4.30 p.m.; leave Malmö 6.45 p.m.
Arrival Copenhagen 7 a.m.

Paris from the Air

The latest attraction for visitors to Paris is to be taken up to view the city from the air. The Compagnie Aérienne Francaise has arranged for touring aeroplanes to fly over the city every Sunday. The first flight took place last Sunday, when some thirty tourists were taken by special car from the Opera to Le Bourget, where they embarked in aeroplanes. An interpreter pointed out to them the principal buildings and points of interest, which could be plainly seen in spite of the great altitude of the aeroplanes.

Experiments in H.M.S. "Argus"

H.M. seaplane carrier *Argus* at Plymouth is being prepared for secret experiments and is closed to all visitors, even to naval officers from other ships. She was originally designed as an Italian liner, but was completed as a seaplane carrier during the war.

Nungesser Air Company

The well-known Ace, Charles Nungesser, is establishing an aerial company, "Nungesser Aviation," which will undertake the training of pilots and conduct aerial tours throughout France.

There are already about thirty pupils in the school. Several aerial lines are actually in course of achievement, and the prices are lower than those for motor car tours.

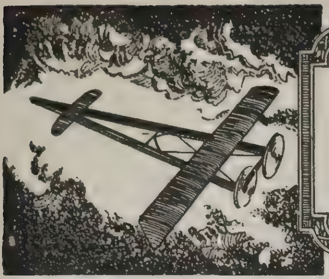
New Spanish Aerial Routes

According to a statement made in Madrid on August 24th, new aerial post routes will be created between the following towns: Seville and Larache, Barcelona and Palma-de-Mallorga, and Malaga and Melilla.

The aerodromes to be used at each point will be those belonging to military aeronautics. On the first of these routes there will be two intermediate landing-grounds at Lebrija and Vejez-de-la Frontera.

Ten aeroplanes will be employed on the first service, which will be daily. The second and third services will also be daily.

The aerial line from Barcelona to Palma, opened on March 18th, has not yet become a regular service.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

CLUBS

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921 Ravenna Boulevard, Seattle, Wash.
BAY RIDGE MODEL CLUB
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INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.
TRIANGLE MODEL AERO CLUB
Baltimore, Md.
NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.
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1726 M Street, N. W. Washington, D. C.
AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., N. Y. City
AERO CLUB OF LANE TECHNICAL HIGH SCHOOL
Sedgwick & Division Streets, Chicago, Ill.

The Curtiss Model

(*Continued*)

The tail or rear part of the machine should be kept as light as possible without sacrificing strength because we must keep the centre of gravity of the model as far forward as possible to make the machine exactly to scale. This is the main reason I have limited the length of the motor stick.

The accompanying drawing shows clearly the construction and method of fastening or rigging the main planes.

The planes are built up of wood, reed and thin strips of bamboo. The main spars are made from strips of ¼ x ⅛-inch spruce, the edging is ⅛-inch round reed and the ribs are made of two strips of bamboo laid one over the other to form a double surface rib.

To construct the main plane lay the two main spars the distance apart as given in the drawing and fasten the bottom part of the ribs in place, with thread and glue. The bamboo strips should be as thin as possible to save weight, because being of double surfaced construction it would be an easy matter to construct the wings, too heavy to fly, if the ribs were cut thick.

When the bottom parts of the ribs are fastened in place bend to the shape shown in the cross section at the left hand bottom of the drawing.

Next fasten the reed edging in place laying it on the top of the rib pieces at the ends. The tips of the wings should be bent to a convenient and attractive curve, and the main spars should be tapered from ¼″ to ⅛″ at the ends and the reed fastened to them.

It will be noticed that a space is left out of the wing plan in the drawing to show the shape and size of the ailerons. It is optional whether the wing is made with the ailerons cut out and movable or the wing is made solid, that is having no ailerons, I would prefer the former as the model would then be able to perform different stunts in the air by moving the ailerons up or down, etc.

Should the model builder prefer to make the wing with ailerons he should cut off the two end ribs on each side of the plane at the rear main spar as shown at the right side of the plan.

The aileron is then made to conform to the shape of the trailing edge of the plane.

When the bottom parts of the ribs are fastened in place and bent to the desired curve, the top part of the ribs should be cut and bent to the proper curve. Notice that the bottom rib strips lie under and are fastened to the reed but the top strips do not lay over the reed but butts against the reed and the ends are fastened to the under strips just a fraction of an inch before meeting the reed edging.

The bottom plane is constructed in the same way, but the model builder should be careful to construct one right and one left side. There are no ailerons in the bottom wings the ends have a large curve at the trailing edge.

The method of construction is shown at the right hand top of the drawing and is clear enough to show the method of spacing and fastening the ribs, spars and reed.

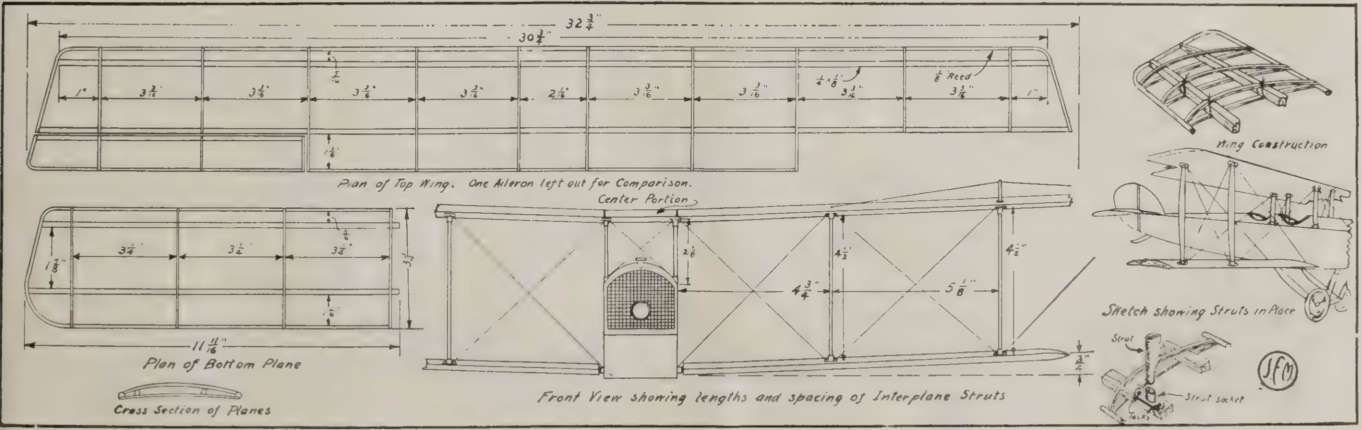
The Curtiss machines have a center panel over the fuselage the wings being made into two pieces and fastened to this section, but for ease of construction I have made the plane in one piece and I think the model builder will find it better when fastening to the model.

The covering is next put on. Silk or paper can be used, but the former will give the best all around service and make the neatest job.

To fasten the covering to the planes use hot glue. This is made in a small glue pot which may be purchased at almost any hardware store. The glue is boiled in water until it reaches the consistency of paint. Apply a little to the edging and place the silk in place holding it until glue sets. The silk should be fastened at the ends first and stretched as tightly as possible. When set it is an easy matter to fasten along the entering edge and then along the rear edge taking care to pull up tight so no wrinkles appear.

When covering the wings the bottom side of the top planes and the top of the bottom planes should be put in place first as it is then an easy matter of fastening the strut sockets in place, after which the other sides may be covered.

(*To be continued*)



Plan of Top Wing. One Aileron left out for Comparison.

Plan of Bottom Plane

Cross Section of Planes

Front View showing lengths and spacing of Interplane Struts

Wing Construction

Sketch showing Struts in Place

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

To the Boys at Naval Air Station, San Diego, Cal.

I'd like to go across the world
  Up in an aeroplane
If I could sail that way I'd feel
  That Life was not in vain;
I'd like to go to every port
  From Nome to Pago-Pago,
But most of all I'd like to see
  You boys at San Diego.

It must be great to float from earth,
  To lose your dusty fetters,
And jog about to take the world
  It's after breakfast letters.
Perchance sometimes you dent your dome,
  Or break a slat or two,
But when you tell the folks at home
  You make them think it's true
That if a thing like that should strike
  On you, you'd never blubber
Because by heck, you've practiced till
  You bounce just like red rubber.

I'd like to know the meanings of
  The things that you are learning,
And just to think of swimming there
  It fills me up with yearning.
I don't think I could save a life
  If Captain Bean was looking,
And so you bet at every show
  I'd be the first at booking;
To watch you hail folks from the tea
  Or save them from the soup,
(Or what you call your noble work)
  Would simply make me whoop.

Well, here's good-by, I hope that you
  Think I might like you better,
If I knew more about you all,
  And send me on a letter.

From Mae S. Greenwood,
Oakland, Cal.

—North Island Naval Air Current.

S. O. S. has a different meaning these days. It now stands for "short on suds."

Maybe You Do

When two little lips are upturned to your own
With no one around to gossip about it,
Do you pray for endurance to let them alone?
Well, maybe you do,
  But I doubt it.

When a shy little hand you are permitted to seize
With a wonderful softness about it,
Do you drop it with never the tiniest squeeze?
Well, maybe you do,
  But I doubt it.

When a tapering waist is in reach of your arm,
With a wonderful plumpness about it,
Do you argue the point twixt the good and the harm?
Well, maybe you do,
  But I doubt it.

M. C.

The Radio Telephone—A New Indoor Sport

"Tuning-in" on wireless telephone communications between San Pedro and Catalina Island is becoming quite a favorite sport in Southern California. All of which illustrates the fact that wireless telephone communication is far from being a private means of vocal intercourse.

For example: One young lady in Los Angeles with a very pleasing voice called the room clerk at the St. Catherine's Hotel and requested that a room with twin beds be reserved for her over the week end. Some big gruff voiced gob, presumably on one of Uncle Sam's destroyers, somewhere in the Pacific, "lipped in" and inquired what the argument was about. The room clerk is trying yet to square himself with the prospective customer.

Then again: A young couple were conversing via wireless between Pasadena and Catalina Island. She asked him if he had received her last letter and John said "yes, dear." "Well, don't pay any attention to what I said in that letter, because I didn't mean a word of it and I am sorry." And John said that was all right, as he was used to such treatment. Whereupon another receiver went bang upon its hook and all communication was lost.

Then you can hear the afternoon baseball scores being relayed to the resort island and a few late market reports. Believe us—it's an interesting sport.

One Explanation

"Rastus, what's an alibi?"

"Dat's provin' dat you wuz at prayer meetin' whar you wasn't, in order to show dat you wasn't at the crap game whar you wuz."

The All-Metal Ace

Bugler Gardenhire, our all-metal ace, is being accused by his friends in headquarters of wasting government rations in a scandalous manner. All dolled up in helmet and goggles, he boarded the Ruggles Orientator over in hangar 8 Tuesday afternoon. Lieut. Anderson operated the stick for something like an hour or two and—well, our bugler was unable to blow recall.—*Fly Leaf.*

Lochinvar Up-to-Date

1800

O young Lochinvar is come out of the West;
Through all the wide border his steed was the best.
And, save his good broadsword, he weapon had none—
He rode all unarmed and he rode all alone.—*Scott.*

1895

The same Lochinvar has progressed a few pegs;
His trust is in wheels, not in poor horse's legs;
He kidnaps his lady-love, faithful and true,
Per bicycle built as a tandem for two.

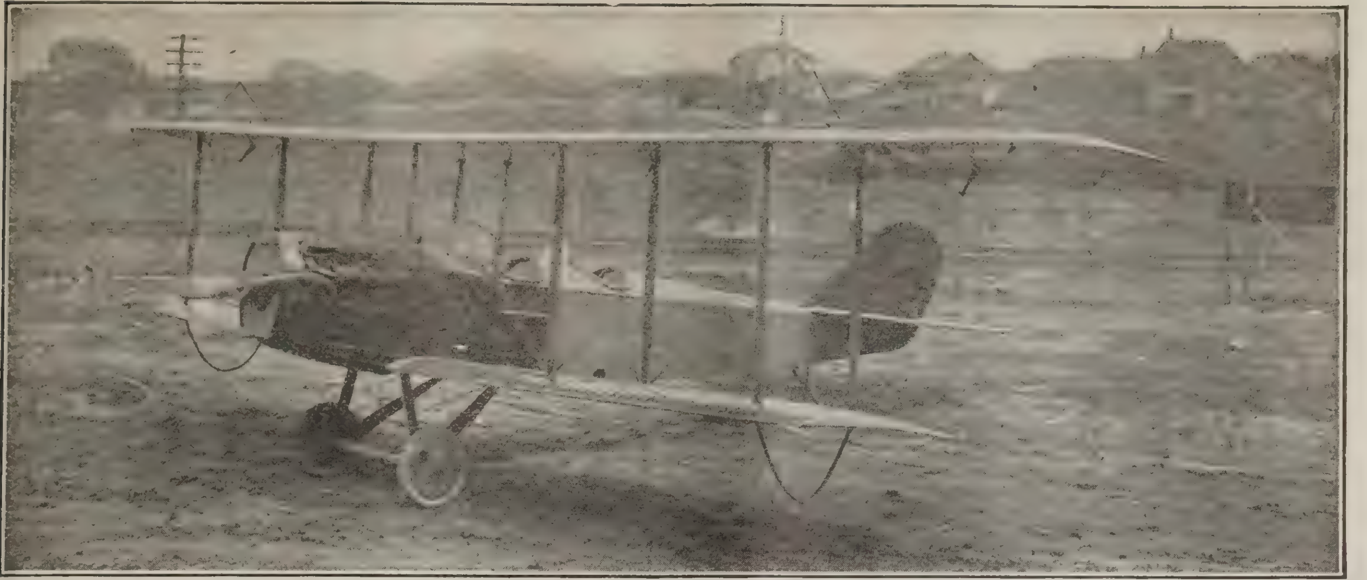
1910

Again Lochinvar gets a move on himself,
The lady survives though the bike's on the shelf;
There's a honk of a horn, a whizz and a whirr,
A high-power car helps him make off with her.

1920

And still Lochinvar his fair lady pursues,
Yet mere earthly methods no longer he'd use—
He blows in like the wind to cop out his queen
Who falls for naught less than a flying machine.

—*Judge* (New York).



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Quick Take Off Fast Climb
Remarkable Durability

Built for business and pleasure. A demonstration convinces the prospective purchaser.

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Harry Hiles, Cheyenne, Wyo., for Southern Wyoming.

Northwest Aircraft Corporation, Newell, S. D., for Western South Dakota.

Erick Aviation Company, Erick, Okla., for Western Oklahoma and Pan Handle.

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4 x 5 Folmer & Schwing Aero Camera, Type E. box all metal, finished in standard Army Grey, equipped with Focalplane shutter, automatically set when plates are changed, 8½" B. & L. Tessar Ser. 1C F:4.5 Camera, complete with 18 septum plate magazine and carrying chest. Price $140.00.

Send for information on any type of photographic apparatus and Motion Picture Cameras. We have them all.

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109 N. Dearborn St., Chicago, Ill.

New Curtiss Ox-5 Motors

Latest motors built by the Curtiss Company at Hammondsport, each motor packed in weather proof case, complete in every detail, including propeller hub, tachometer gears, pressure pump, complete set of tools and log book showing test runs.

NEW STANDARD PLANES EQUIPPED WITH NEW OX-5 MOTORS

Set Up Ready to Fly, or Crated for Shipment

IMMEDIATE DELIVERY FROM CHICAGO

LEE HAMMOND

2216 So. Michigan Avenue Chicago, Illinois

COMPLETE Stock Wings, Landing Gears, Shock Absorber Cord and spares of all kinds for JN4D, Canucks, J-1 Standard, F Boat and OX5 Motors; also New and Used Ships, Boats and Motors—big variety.

Special: — Mahogany Copper Tipped Buffalo Airplane Co. OX5 Propellers, list price $65; our price $51; lots of 3 at $41; lots of 6 at $35 each.

Paragon Variable Pitch Copper Tipped OX5 Propellers, list $74.40; our price, $57; lots of 3, $45; lots of 6, $39.

Our Specials Will Please.

Rush Orders Our Specialty. Try Us and See.

THE FLOYD J. LOGAN AVIATION CO.

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Curtiss Distributor in Ohio Phone Ontario 949

Terms: One-third with order; balance C.O.D.

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Two or Three Passenger

$3000—$4500

Immediate Delivery at Chicago

JAMES LEVY AIRCRAFT CO.

2031 TO 39 INDIANA AVENUE, CHICAGO

(Continued from page 135)

nual meeting shall be sent to each member ten days prior thereto."

No provision is contained in the Charter with respect to removal of Governors or Officers during their respective terms of office, for cause or otherwise. And the only provisions affecting the removal or suspension of members, officers, etc., is found in Sections 1 and 2 of Chapter IX of the By-Laws, under the heading "Discipline", to wit:

> **"Chapter IX. Discipline—Section 1. At any regular or special meeting of the Board of Governors, by a vote of three-fourths of the Governors present at such meeting, any member of the Club may be suspended or expelled for any cause considered, in the judgment of the Board, as being inimical to the welfare or best interests of the United States or any of its Allies or of the Club."**
>
> **"Section 2. The Executive Committee may, by a majority vote, for similar cause, suspend any member of the Club for any period, definite or indefinite, subject to review, modification or recision of such suspension by the Board of Governors."**

There can be no pretense that the Board of Governors was abolished by virtue of the aforesaid provisions. It is well settled and elementary that the power to remove a director or officer for cause can be exercised only by the constituent body, unless otherwise provided by statute or charter, and then only in a corporate meeting duly assembled in pursuance of notice and by a vote of a majority of the assembled quorum counting the one on trial who has the right to be counted and to vote; and that such removal cannot even then take place without notice and a judicial inquiry analogous to that which satisfies the expression "due process of law." (10 Cyc 745; Wachtel v. Noah W. & O. Ben. Soc. 84 N. Y. 28; Matter of Reed, 95 Misc. 695; Peo. v. Medical Soc. 32 N. Y. 187; Peo. ex rel. Holmstion v. Ind. Dock B. Benev. Union, 164 App. Div. 267; Matter of Barry v. The Players, 147 App. Div. 704; aff'd 204, N. Y. 669.)

POINT IV

The persons elected or appointed as Directors, Governors or Officers as a result of the alleged meeting of August 16, 1920, are usurpers pure and simple; have no authority in law or fact to sustain their positions and should be removed forthwith and restrained from exercising the functions and duties of offices to which they are absolute strangers; and the lawful and duly elected Board of Governors and Officers restored.

Respectfully submitted,

NUGENT & NUGENT, *Attorneys for the Petitioners,*
Office and Post Office Address, 280 Madison Avenue,
Borough of Manhattan, City of New York.

(Kent v. Quicksilver Mining Co., 78 N. Y., 159; Raub v. Gerken, 127 App. Div. 42, and cases hereinbefore cited.)

In the leading case of Kent v. Quicksilver Mining Co., 78 N. Y., 159, supra, the Court distinctly held that a private corporation cannot repeal a by-law so as to impair rights which have been given and become vested by virtue of the by-law; *and this although the power is reserved by the charter to alter, amend or repeal its by-laws.* The Court per Folger, J. said:

> **"The by-law entered into the compact between the corporation and every taker of a share; it was in the nature of a contract between them. The holding and owning of a share gave a right which could not be divested without the assent of the holder and owner; or unless the power so to do had been reserved in some way. (Mech. Bank. v. N. Y. & N. H. R. R. Co., 13 N. Y., 599-627) . . . That right is as inviolable as is any right in property, and can no more be taken away or lessened, against the will of the owner, than can any other right, unless power is reserved in the first instance, when it enters into the constitution of the right; or is properly derived afterwards from a superior law giver. . . .**
>
> *"There is a power in this charter to alter, amend, add to or repeal at pleasure by-laws before made.* It is argued from this that it was in the power of the corporate body, in due form and manner, to alter the by-laws which had fixed the amount of the capital stock and the number and relative value of the shares thereof. The power to make by-laws is to make such as are not inconsistent with the constitution and the law; and the power to alter has the same limit, so that no alteration could be made which would *infringe a right already given and secured by the*

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STRENGTH REPUTATION SERVICE

contract of the corporation. Nor was the power to alter, to the extent of affecting the contracted relative value of a share, reserved when the share was sold to the stockholder so as to enter into and form a part of the contract. An alteration is a *pro tanto* repeal; *but no private corporation can repeal a by-law so as to impair rights which have been given and become vested by virtue of the bylaw afterwards repealed.* All by-laws must be reasonable and consistent with the general principles of the laws of the land, which are to be determined by the courts when a case is properly before them. (The Master, etc., v. Green, 1 Ld., Raym., 113). A by-law may regulate or modify the constitution of a corporation, but cannot alter it. (Rex v. Cuttbush, 4 Burr 2204; R. W. Co. v. Allerton, 18 Wall 233.) The alteration of a by-law is but the making of another upon the same matter. If the first must be reasonable and in accord with principles of law, so must that which alters it. *If then the power is reserved to alter, amend or repeal, and that reservation enters into a contract, the power reserved is to pass reasonable by-laws, agreeable to law. But a by-law that will disturb a vested right is not such.* (See Gray v. Portland Bank, 3 Mass. 363; Frant on Corp. 91.) And it differs not when the power to make and alter by-laws is expressly given to a majority of the stockholders, and that the obnoxious ordinance is passed in due form. . . ."

POINT V

The duly elected directorate had a vested right to their offices for the specified term and could not be summarily removed therefrom before the expiration of their respective terms without cause. The relief sought should be granted.

The petition asks that the Court declare irregular, invalid and of no effect the so-called elections as governors of the club of Arthur O'Brien, Philip A. Carroll, Consuelo Seone, Philip J. Roosevelt, Maurice Cleary, Benjamin F. Castle, Charles E. Merrill and Caleb S. Bragg, all of whom were put in as governors of the club by the individuals who illegally assumed control of the club on August 16th, as part of the nefarious conspiracy to destroy the Aero Club as a national, moral force and make it assume the obligations of the Flying Club, which caused a deficit of over $50,000 to the latter during the past year.

Tear off and keep for reference

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IMMEDIATE DELIVERY F.O.B. ASBURY PARK, N. J.

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Canadian JN4, new, with rebuilt ox-5 motor	3000.00
Rebuilt motors (ox-5) A-1	400.00
New wings, uppers or lowers, covered, with fittings	200.00
Uncovered, with fittings	100.00
Ailerons, covered	40.00
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Uncovered	20.00
Rudders, uncovered	20.00
Vertical fins, covered	20.00
Uncovered	10.00
Center sections, uncovered	50.00
Rudder bars	5.00
A-1 used radiators, like new	25.00
Axles	7.00
All wires, A-1, each	2.00
New Canadian propellers	20.00
All fittings, new	2.00
Landing gear vees, Canadian or American, each	10.00
Creagh Osborne Compasses	20.00
Special tail skid shoe for golf links	3.00
Motor (ox-5) parts	33% off

ALSO MANY OTHER BARGAINS.

"You Can Safely Bank on De Luxe Parts"

Overhauled motors guaranteed to show 1375 on the ground.

Planes tested and demonstrated at our airdromes.

Flying instruction (prices on request).

We charge $25.00 per wing for boxing, $2.00 for radiators, gas tanks, and $5.00 for small surfaces. No charge for propellers or motors. We do not assume responsibility for delays in transit.

50% deposit on all wing or motor orders, otherwise C.O.D., with privilege of inspection.

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for the Lubrication of
AERONAUTICAL MOTORS

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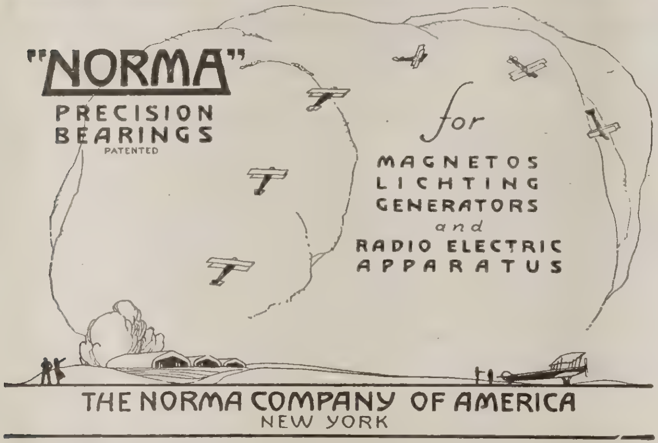
The Oldest and Largest Manufacturers of Castor Oil in the United States
120 BROADWAY NEW YORK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Largest Exclusive Jobbers in U. S.

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for All Types Aircraft

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New and Used Canuck Planes and Parts
Largest Stock in U. S.
Write for Price List
JAMES LEVY AIRCRAFT CO.
2033 to 39 Indiana Avenue, Chicago

"Airplane Supplies"

NATIONAL AEROPLANE COMPANY
549 W. Washington St. **CHICAGO, ILL.**

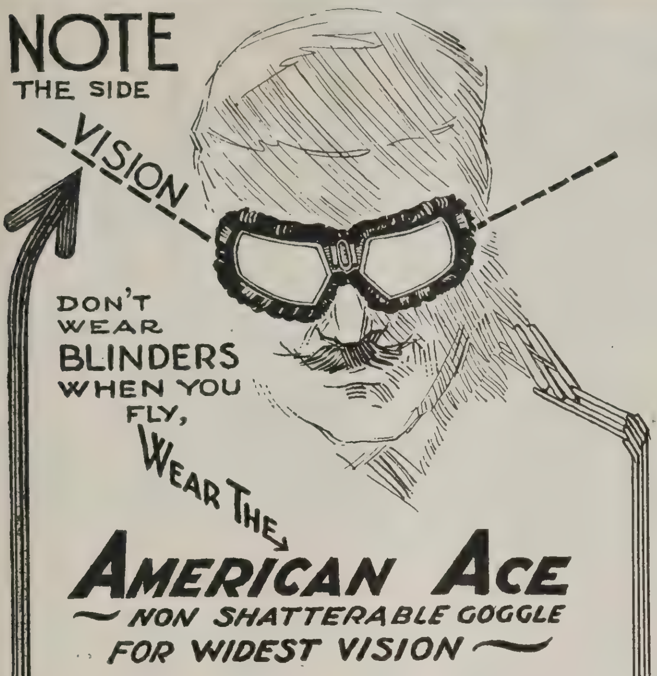
EVERY DOLLAR that is spent for advertising in a publication that misrepresents its circulation and thus obtains money under false pretenses is a dollar lost to the publishers who give full value.

In self-defense, therefore, the "above board" publishers have an independent audit made of their circulation records by the Audit Bureau of Circulations and invite their competitors to do likewise.

When excuses or evasions are given for declining the challenge, the advertiser can draw his own conclusions.

There are many excuses for not belonging to the A. B. C. There is only one reason.

AERIAL AGE is a member of the Audit Bureau of Circulations. There are no hidden mysteries about its circulation records.



The American Ace Aviators' Goggle is the result of the war's demand for a non-shatterable goggle fitted with optically perfect lenses in a meniscus form to insure both safety and the widest possible vision. Price $7.50.

GEO. S. JOHNSTON CO.
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For Canada:
CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of AERIAL AGE WEEKLY, published WEEKLY at NEW YORK, N. Y., for OCTOBER 1, 1920.

STATE OF NEW YORK }
COUNTY OF NEW YORK } ss.

Before me, a NOTARY PUBLIC in and for the State and county aforesaid, personally appeared G. DOUGLAS WARDROP, who, having been duly sworn according to law, deposes and says that he is the BUSINESS MANAGER of the AERIAL AGE WEEKLY and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Name of—	*Post office address—*
Publisher, AERIAL AGE CO., INC.	280 Madison Avenue, New York
Editor, HENRY WOODHOUSE	280 Madison Avenue, New York
Managing Editor, G. DOUGLAS WARDROP	280 Madison Avenue, New York
Business Manager, G. DOUGLAS WARDROP	280 Madison Avenue, New York

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

AERIAL AGE CO., INC.	280 Madison Avenue, New York
HENRY WOODHOUSE	280 Madison Avenue, New York
G. DOUGLAS WARDROP	280 Madison Avenue, New York

3. That the known bondholders mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

NONE.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is......................................
(This information is required from daily publications only.)

G. DOUGLAS WARDROP,
Business Manager.

Sworn to and subscribed before me this 25th day of September, 1920.

DANIEL F. NUGENT,
Notary Public, Queens Co., 907; N. Y. Co., 49.

[SEAL.]

(My commission expires March 30, 1921.)

Form 3526.—Ed. 1916.

NOTE.—This statement must be made in duplicate and both copies delivered by the publisher to the postmaster, who shall send one copy to the Third Assistant Postmaster General (Division of Classification), Washington, D. C., and retain the other in the files of the post office. The publisher must publish a copy of this statement in the second issue printed next after its filing.

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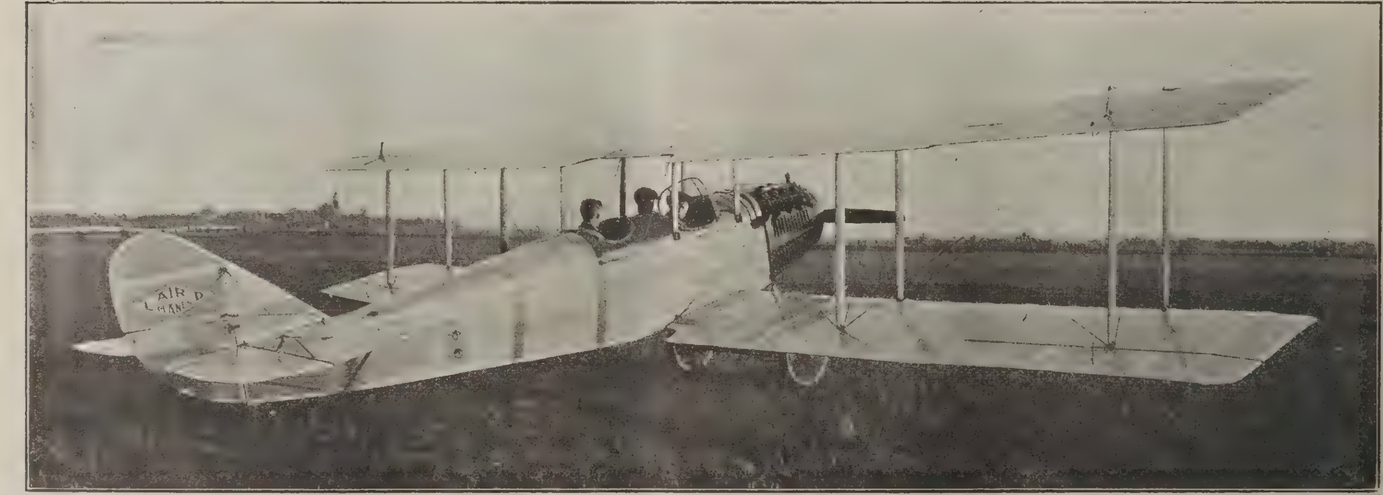

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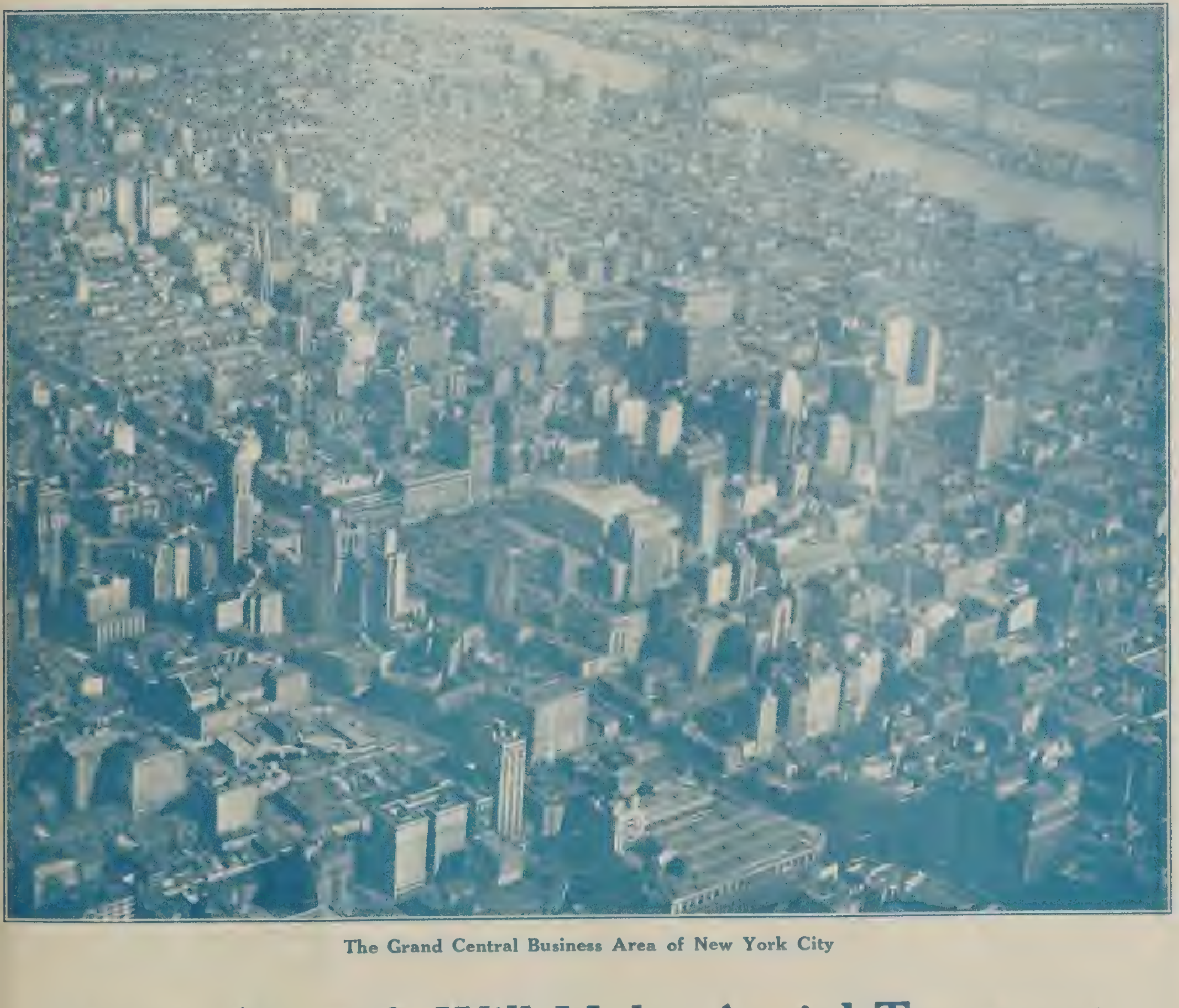

The Grand Central Business Area of New York City

Large Aircraft Will Make Aerial Transport Lines Public Utilities

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions; Domestic. $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

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VOL. XII. NEW YORK, OCTOBER 18, 1920 No. 6

LARGE AIRCRAFT WILL MAKE AERIAL TRANSPORT LINES PUBLIC UTILITIES

WHILE it is true that a hundred aerial transport lines could be operated successfully and at a profit today with aeroplanes carrying only a ton of useful load, it is also true that general aerial transportation will come as soon as we produce aircraft capable of lifting from ten tons of useful load and up—the larger the better.

Large aircraft will make aerial transport lines public utilities. Their economic efficiency will justify the issue of municipal bonds to pay for the establishing of aerial transport lines and suitable airports. We have conferred with the officials and leading business men of over forty cities and find a growing appreciation of the fact that aerial transportation brings many advantages of commercial value—with corresponding disadvantages for the backward cities that do not have aerial transportation.

For instance, during our visit to Detroit we were told by a leading member of the Chamber of Commerce that since the inauguration of the aerial mail, Cleveland has been getting its mail from the West about sixteen hours ahead of Detroit, which fact was proving a serious commercial handicap to Detroit as the business men of Cleveland had their inquiries replied to, and often had a representative on the ground, before Detroit houses even received the inquiry. Before the advent of the aerial mail the two cities got their mail at about the same time. The seriousness of this situation makes it imperative for Detroit to get aerial mail as soon as possible, and is a good illustration of the important part aerial mail is to play in commercial life of the future. It is needless to say that Detroit is making every endeavor to secure the aerial mail. It has welcomed and given substantial support to Mr. Thomas F. Dunn in the organization of the U. S. Aerial Express Co.

Cities that participate in and encourage the development of aeronautics are very likely to be repaid in the near future by being selected as aircraft construction centers, which will bring to these cities a lot of business and international and national distinction.

By participating in aeronautic progress, cities really take an option on the business which will surely come with the development of large aeroplanes and dirigibles, as well as the manufacturing of tens of thousands of small aeroplanes for which a demand is fast being created.

Aeronautics is developing very fast and the construction of large aeroplanes and dirigibles is going to make the aeronautic industry more or less like the ship-building industry in character, excepting that airships can be built inland.

Supplying the aircraft required to operate a single line across the continent would keep the largest aircraft manufacturer busy for a year.

This fact has been proven by Mr. Alfred W. Lawson, the eminent aircraft constructor, who during the past year flew his air liner from Milwaukee to different cities and found the interest in aerial transportation so great that he lost no time in deciding to proceed to establish aerial transportation lines, and he found that it takes a year to produce a sufficient number of large aeroplanes to establish and operate a substantial aerial transportation line. This had also been found to be true by F. Handley Page, the Vickers, Airco and Bristol Companies, Caproni, and Henry Farman, and other British, French and Italian aircraft manufacturers who have been operating air lines, as well as by the U. S. Post Office, whose figures on equipment and cost of maintenance of aerial transportation are most reliable.

Half Dozen Aerial Trunk Lines

There is need for half a dozen aerial trunk lines across the continent and for several hundred connecting lines.

The new wall map of the U. S. and Canadian Airways (obtainable from the Aeronautic Library, Inc., 299 Madison Avenue, New York City, Price $5.00) shows conclusively that six transcontinental aerial trunk lines and a hundred connecting lines could be operated without any competition, but rather the opposite, because each would be part of a system of aerial transportation contributing to increasing the volume of business for the other.

Production of Large $500,000 Seaplanes

Producing large seaplanes for half a dozen transatlantic air lines would keep busy a score of large factories and these factories would have to be almost as large as ship-building yards. The flying boats being planned by the U. S. Navy to be constructed this year are three times as large as the famous NC seaplanes which flew across the Atlantic, and will, no doubt, cost $200,000 each. Caproni, the noted Italian manufacturer, who constructed a 25-ton seaplane to carry 50 passengers, affording them comfort and convenience such as is obtained in first class steamers, has designed and is going to build, possibly in the United States, a larger air liner to be equipped with 12,000 horsepower and to carry from 400 to 500 people. In other words, aircraft are reaching such tremendous sizes that they have to be built in huge yards, like ships of the sea.

The Aerial League of America's contest for designs for large aeroplanes capable of lifting a useful load of twenty, fifty, one hundred, one hundred and fifty and two hundred tons, for which Mr. Henry Woodhouse has offered prizes amounting to $5,000, is, therefore, an epoch-making event.

STATUS OF THREE A. C. A. LEGAL ACTIONS

HEREWITH summarized is the status of the three legal actions taken by governors and members of the Aero Club of America to right the wrongs committed by a few individuals who attempted to get control of the club by holding an illegal meeting on August 16th, during the absence of a large number of governors and members of the club.

FIRST ACTION: Application for injunction was instituted on July 20th. Arguments on motion for a temporary injunction *pendente lite* was heard before Supreme Court Justice Edward J. Glennon on July 30th. Additional affidavits were submitted to the court on August 2nd. The defendants raised the issue of facts, therefore the temporary injunction was denied on August 10th and the case now goes to trial, when witnesses will be summoned and evidence produced.

SECOND ACTION: Order to show cause why a peremptory writ of mandamus should not be issued to reinstate Henry Woodhouse as a member and governor was obtained on August 6th from Judge Glennon. It was argued before Judge William P. Burr on August 9th and peremptory writ denied on August 24th, but alternative writ granted September 10th, and the case goes to trial, when witnesses will be summoned and evidence produced.

THIRD ACTION: Application to the court to oust the new directors elected at the illegal elections of August 16th. Defendants asked for a week's grace, which was granted by the petitioner. The motion was heard by Supreme Court Judge Joseph T. Newburger on October 2nd. Decision is awaited in the near future.

Violation of Statutes Admitted by Defense in A. C. A. Case

Supreme Court Justice Joseph E. Newburger on October 2nd heard the arguments on the petition to oust from the Board of Governors of the Aero Club of America the following: Arthur O'Brien, Philip A. Carroll, Consuelo Seone, Philip J. Roosevelt, Maurice Cleary, Benjamin F. Castle, Charles E. Merrill and Caleb S. Bragg, all of whom were put in as governors of the club by the individuals who illegally assumed control of the club on August 16th, as part of the nefarious conspiracy to destroy the Aero Club as a national moral force and make it assume the obligations of the Flying Club, which caused a deficit of over $50,000 to the latter during the past year.

The defense attempted first to becloud the issue by claiming that this third action was identical to the two previous actions now in court, going to trial, but their contention was easily upset. Having failed in this respect, and finding themselves face to face with the fact that the New York State Membership Corporation Laws, supported by the many Federal, Supreme and Court of Appeals decisions quoted in the last number of AERIAL AGE, support the action to oust them, the defense once more resorted to extraordinary misrepresentations of facts.

They admitted the violation of the statutes, but claimed that the said illegal elections of August 16th represented the desires of five hundred members of the club, with only five votes against it, and pleaded that it would cause undue hardship to have to undo what had been done at and following the said illegal elections of August 16th.

Thereupon, additional affidavits and over three hundred proxies and letters from objecting members were presented by the petitioner.

The tactics adopted by the defense are similar to the tactics which amazed the U. S. Senate and House of Representatives investigating committees during the investigations of aircraft scandals. Facts are suppressed, twisted and misrepresented, the written and unwritten laws which govern the affairs of men are deliberately violated in attempts to conceal previous violations of the statutes. How much easier it would be to right the wrongs committed last summer and thereby bring the legal actions to an end!

Here is an instance of the unethical tactics adopted to get control of the club by the legal meeting of August 16th referred to:

At various times subsequent to the mailing of requests for proxies for the so-called meeting held on August 16, 1920, and prior to said date the writer received considerably more than one hundred calls, letters, telephone communications and telegrams from members of said Aero Club of America, objecting to the calling of this illegal meeting and the objects sought to be perpetrated thereat; and among others deponent received a communication and proxy from a member which was sent by registered mail, addressed to him personally, but notwithstanding had been opened at the Aero Club of America club rooms. Thereupon the writer personally visited the office of the Secretary of the Aero Club of America regarding the matter of opening his personal mail and requesting information as to how many such protests against said irregular meeting had been received and whether they would be presented thereat to show that a large number, without knowledge of the fact and misinformed as they had been by the defendants, nevertheless resented this unconscionable plan and had revoked their proxies.

On such occasion upon entering the said Secretary's office the writer saw on a desk two separate piles of proxies placed flat upon each other and held together by rubber bands. One of the said piles had a white slip of paper placed beneath the rubber band and designated the nature of such proxies as "opposed." This pile was by far the larger of the two and contained approximately two hundred proxies. The Secretary of the club was not in his office at the moment, and while awaiting his return, the writer glanced through the said pile of proxies marked opposed, and which were held together by a rubber band and noted that in every case the members had either written across the proxy, upon the margin or in letters attached thereto, that they were against the meeting of August 16, 1920, and its objects and requesting revocation of former proxies (three separate and distinct sets of proxies having been mailed out to the members at various times by the said defendants, each accompanied by self-addressed and stamped envelopes, and many members signed the first set of proxies casually thinking that it was in order to do so and a routine and customary matter, a circumstance largely counted upon to enable these individuals to carry out their plans).

Subsequently, the writer was advised by another governor of the club that he had likewise observed these packages of proxies and had noted that the pile marked opposed was of considerable magnitude. Thereupon and on or about August 11, 1920, the writer called upon the said Secretary of said club, and explained to him that a number of members had notified him that they had revoked their proxies and desired to know whether such revocation would be acted upon and presented at such meeting of August 16, 1920, and if those opposed would be voted upon. The Secretary stated that it was not within his province to determine what would be done. Thereafter the writer met Mr. Henry A. Wise Wood, a Governor of the club, who was in the club house library at the time, and again asked Mr. Wood whether or not proxies opposed would be acted upon and revocations of former proxies honored. Mr. Wood stated the legal committee would decide on the necessity of presenting said proxies.

Suffice it to say that no such proxies were ever presented and the revocation of former proxies were ignored. All opposition was put down by unethical methods and might made right at least so far as the alleged special meeting of August 16, 1920, was concerned.

Another instance, the defendants claim that they had to take over the ruinous Flying Club lease because the Aero Club's lease was expiring on October 1st. This is another misrepresentation. The fact is that the club house at No. 297 Madison Avenue was and is available for use and the writer under date of October 1, 1920, received the following communication from the agent of this property, to wit:

> **"Your letter of August 6th asking the situation in regard to 297 Madison Avenue, then under lease to the Aero Club of America, was referred to me yesterday by Mr. Williams. In reply I beg to state that the Aero Club lease expired October 1st and they formally surrendered the premises yesterday.**
>
> **"The property is now, therefore, in the market and we would be very glad to consider a lease to your club, if you would care to go into it."**

Not all the wrongs committed can be righted, but the problem can be solved by moving back to the club house and restoring the Board of Governors as it existed on August 1, 1920. If this is done before the annual elections of November 8th the club will be restored on a satisfactory basis and the legal actions will end. If this is not done, then the legal actions continue and inasmuch as so many provisions of the statutes have been violated by the defendants, the ultimate results can only be the setting aside of all actions that have been taken since the illegal meeting of August 16th and the elections of November 8th would also be illegal, so long as the old Board of Governors has not been restored.

The News of the Week

Pulitzer Air Race is Open to World

With eighteen army planes entered for the speed race from Mitchel Field, Thanksgiving Day, for the Pulitzer Trophy, the lists were thrown open to flyers from all over the world, with a good prospect of important European contestants. Inquiries received from Great Britain, France, Italy and Canada led to the announcement by the Chairman of the Contest Committee of the Aero Club of America, of the plan to make it an open event for all comers.

There is a strong likelihood that Lecointe, the French pilot, who won the recent Gordon Bennett Cup race at Etampes, France, will be seen in flight at Hempstead. Recent cables announced his purpose of visiting America, and the Aero Club has notified him of the terms of the Pulitzer Trophy race.

The Americans in the Gordon Bennett race, who, because of the difficulties with their machines, made an unsatisfactory showing, are expected to be back and fly for the Pulitzer Trophy. They include Capt. Rudolph Schroeder, Roland Rohlfs, Sergt. Coombs, and Howard Reinhardt.

In addition to the Pulitzer Trophy there are to be a first prize of $2,000 cash, and other trophies and cash prizes for the various classes of machines participating. An important feature of the race is that the mechanics of winning planes are to get cash prizes of one-fifth the amounts awarded to pilots.

F. D. Roosevelt Uses Plane

Kansas City, Oct. 9.—Franklin D. Roosevelt, Democratic Vice-Presidential nominee, flew here late today from Sedalia, Mo., to keep an afternoon speaking engagement.

The plane left Sedalia at 2.30 o'clock, arriving here at 3.50. The pilot was J. N. Lagrone, of Kansas City.

Air Lines Planned to Chicago

Plans for the inauguration of aerial freight and passenger-carrying service between New York to points as far west as Chicago were announced by the Continental Airline Corporation of 17 West Forty-fourth street.

The officers of the Continental Airline Corporation are: Archibald Johnston, former head of the Johnston Aviation Company, of Pittsburgh, President; Arthur Evans, Vice-President; James H. Stone, Treasurer, and Eskil Florman, Secretary. In addition to Mr. Johnston and Mr. Stone, the members of the Board of Directors are Frederick Collum, Assistant Secretary of the National American Bank, and Sidney D. Ripley, of Worthington Whitehouse, Inc.

According to Vice-President Evans, the corporation will begin its service in New York next month, centering its attention for a short time on freight carrying, for which he said there was a real demand. Planes of 6,000 pounds capacity would be used, said Mr. Evans, who indicated that some of them would be of foreign make. In a formal statement Mr. Evans said:

"The scope of the corporation's activities may be set forth as follows: 1. To establish in or near New York an airport, from which will leave daily, on a regular schedule, passenger and freight-carrying airplanes. 2. To inaugurate a northern and southern division. The proposed former division will operate from or near New York to Washington, Baltimore, Albany, Buffalo, Boston, Toledo, Chicago and such other points in the district as demand requires. The southern route will operate from Miami to Key West, Palm Beach, Jacksonville, St. Augustine and other points in that section of the country. 3. To accommodate local sightseers at each air base, and patrons desiring to travel between cities by aeroplane. 4. To accept any commission whereby the aeroplane can be used on a profitable basis."

Mr. Evans said that ex-army and navy aviators would be employed, and stringent rules against "stunt" flying would be enforced. Arrangements were being made, he said, to open ticket and business offices in the cities which would be reached by the service. Mr. Evans said that landing fields were being acquired along the proposed route.

Favors British Air Service to America

London.—At the Air Conference Sir Trevor Dawson, managing director of Vickers, Limited, proposes to raise the subject of negotiations between an American syndicate and the Zeppelin construction firm in Germany for the establishment of a transatlantic service.

Sir Trevor Dawson told a newspaper representative that it was a great pity that a British syndicate had not got into operation for the purpose of starting a transatlantic airship service, and that he intended to bring the matter strongly before the Air Conference.

Four Nations Enter Seven Balloons in Race

Birmingham, Ala.—Seven balloons—three representing the United States, two from Italy, one from France, and one from Belgium—have been entered in the international Gordon Bennett trophy race, which starts from Birmingham Oct. 23.

The American pilots, the Aero Club of America reports, will be Ralph Upson, present holder of the international cup, in the balloon Goodyear II; Lieutenant Richard E. Thompson in an army balloon, and H. E. Honeywell in the Kansas City II.

Captain Hirschauer will represent France, Lieutenant Ernest Denuyter, Belgium, and Major Chevalier Joseph Valle and Major Hugo Madori, Italy.

French Aeronauts Bringing Balloon

Paris.—Captain Louis Hirschauer and an assistant, Leo Nathan, sail October 4 for the United States with a military balloon constructed before the war, to represent France in the Gordon Bennett international balloon trophy race, which will start at Birmingham, Ala., October 22.

Captain Hirschauer's balloon is a standard army bag that has been modified for the race. It has 2,200 cubic meters gas capacity. The men were chosen to represent France by the Aero Club of France.

Sadi Lecointe to Visit U. S.

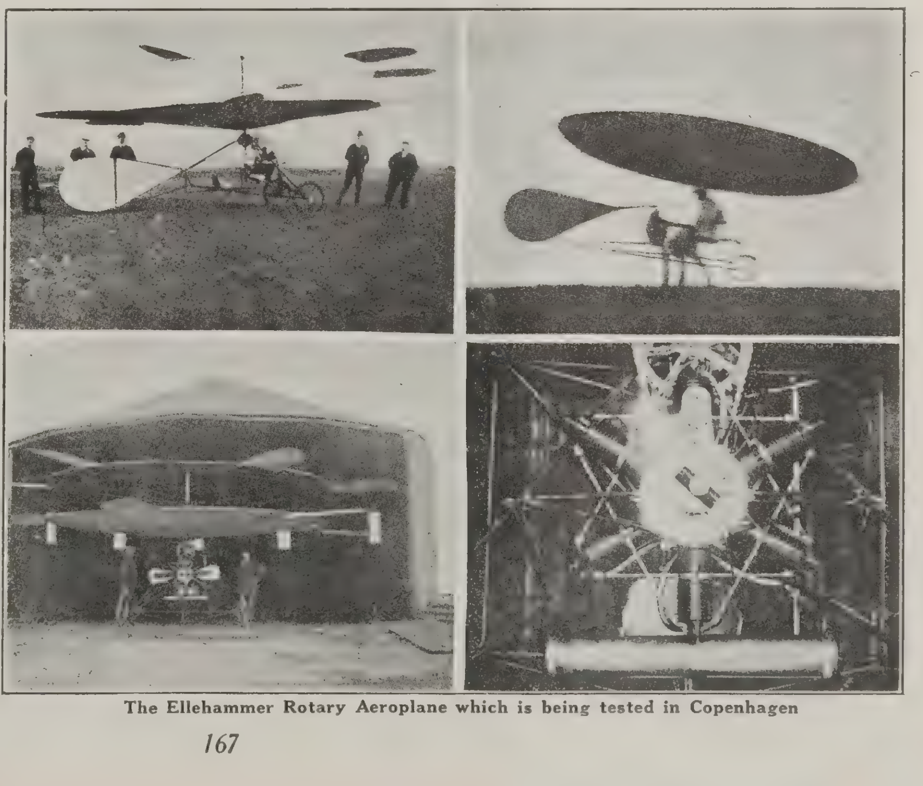
Sadi Lecointe, who won the Gordon Bennett international aviation cup at Etampes, will soon visit the United States, where he will engage in aeroplane races against famous American pilots, says the *Excelsior.*

Aero Limited Service

The monthly statistical sheet of the Aero Limited shows that during September 322 passengers were carried. During the months of June, July, August and September a total of 2,176 passengers were carried.

A Manufacturing Opportunity

On another page of this week's AERIAL AGE there will be found an announcement



The Ellehammer Rotary Aeroplane which is being tested in Copenhagen

of interest to aeroplane manufacturers. Harry E. Tudor, sales manager of the Aircraft division of the Maryland Pressed Steel Co., announces that he is ready to negotiate with firms for the manufacture of Bellanca aeroplanes, and the immense interest which the tests and performances of the C. E. model aroused, makes it an interesting opportunity for the right firm.

Starts Flight from Panama

From the turquoise waters of the Caribbean Sea, Lieut. Charles B. Austin, of the Army Air Service, took off from Panama on the first leg of his flight from the isthmus to Bolling Field, Washington, D. C.

His first landing point will be Jamaica, 650 miles from Panama. Other stops will be made at Havana, Cuba; Arcadia, Fla.; Americus, Ga.; Fayetteville, N. C.; Langley Field, Va., and Washington.

The flight is under the supervision of the War Department, to which Austin will report his daily progress. Special arrangements were made by the department for his landings at Jamaica and Havana through the British and Cuban authorities.

Extends Seaplane Mail Service

Delivery of mail by seaplane between Seattle and Victoria, British Columbia, will commence on October 15, the Postoffice Department has announced. The seaplanes will make close connection at Victoria with transpacific mail steamers. The department also announced that the inauguration of mail delivery service by seaplane from Key West to Havana has been postponed until November 1.

Warning to Aviators

C. F. Marvin, Chief of the Weather Bureau, has requested AERIAL AGE to publish the following important notice of warning:

"The U. S. Weather Bureau conducts upper air investigations by means of kites at the following stations:

Name	Latitude	Longitude
Broken Arrow, Okla.....	36° 02′	95° 49′
Drexel (near Elkhorn), Nebr.	41° 20′	96° 16′
Due West, S. C..........	34° 20′	82° 45′
Ellendale, N. Dak.......	45° 59′	98° 34′
Groesbeck, Tex..........	31° 20′	96° 28′
Royal Center, Ind.......	40° 53′	86° 29′

"Aviators are warned not to approach within 10 miles of these stations, as serious, possibly fatal, accidents would result from the fouling of aeroplanes with the kites or with the wire by means of which the kites are flown."

Los Angeles-San Diego Line Started

Los Angeles.—Commercial aviation became a reality in Southern California recently when an all-metal plane of the Mercury Aviation Co. made its first flight on regular schedule from Los Angeles to San Diego and return with such prominent men as John B. Miller, president of the Southern California Edison Company; H. M. Robinson, president of the First National Bank; Max Fisher, wealthy Riverside man, and Cecil B. deMille, of the Famous Players Lasky Co., and head of the Mercury Aviation Company, and through whose interests and money the all-metal planes were brought to Los Angeles.

The plane left DeMille Field at 12 noon and in a few minutes was lost to the eye in the haze of distance. Just one hour and twenty minutes later word was received from the southern city that the plane and its half billion dollar passenger list had made the landing there.

Naval Aviation News

Photographs recently were made from a navy VE-7 aeroplane of various localities in the District of Columbia, from altitudes of from 1,000 to 10,000 feet. It is intended to make further mapping photographs up to an altitude of 15,000 feet in the same locality, for use by the board of surveys and maps in determining the value of mapping photographs taken at various altitudes.

At least 40 student aviators will be assigned for training in the next class at the naval air station at Pensacola, Florida.

Capt. Stafford H. R. Doyle, of the navy, commanding the naval air station at Hampton Roads, Va., recently was in Washington, having come from his station by aeroplane, on business connected with the personnel and material of the new torpedo plane division of the Atlantic fleet. This division will operate mainly from Hampton Roads, but the Martin bombing and torpedo planes of the group will use the landing field at Yorktown, Va., as soon as that field is ready.

A general view of one of the shops in a German aircraft factory indicating that there is still considerable construction activity

The AIRCRAFT TRADE REVIEW

Pacific Airplane & Supply Co. Active

Reports from California, Arizona and other southwestern states show that commercial aviation is passing from the experimental stage to strictly a business basis.

The Pacific Airplane & Supply Co. of Venice, Calif., which concern has been placing on the market Pacific Standard machines, reports that the appointment of a number of distributors in the southwest, also the sale of planes to individual owners and mercantile concerns where the planes are being used entirely for transportation purposes.

This marks a step in the right direction of commercial aviation. Passenger carrying aviation companies demonstrate to the public that the aeroplane is the swift and safe medium of fast transportation.

A. S. M. E. Organize Aeronautic Section

In the field of aviation a good deal of cooperative engineering work has been done, standards have been established, details of construction perfected, interchangeability secured. Nevertheless there still exists the real opportunity for promoting in a large way the broad engineering development having to do with the future of aerial navigation regarded as an essentially international science, art and business.

To this end the members of The American Society of Mechanical Engineers interested in Aeronautics have organized themselves into a Professional Section on this subject.

Side by side with the development of the engineering features of aviation, which are obvious to all, a few minds have for some years been looking beyond the details of construction into the realm of international aircraft problems, and have, in fact, secured for America a reputation for breadth of vision regarding the future of air navigation throughout the world.

Howard E. Coffin, Jesse G. Vincent, Orvillle Wright, C. F. Kettering, Elmer A. Sperry, James Hartness, John R. Cautley, Lionel S. Marks, Miller R. Hutchinson, Charles E. Lucke and Joseph A. Steinmetz, all prominent in the Aeronautic field in the war, are among those who have registered in the Section.

Book Review

THE LAFAYETTE FLYING CORPS: *By Captain James Norman Hall and Lieutenant Charles Bernard Nordhoff. With* an introduction by Marshal Foch, in 2 vols., illustrated in color and black and white.

Official histories have the reputation of being too often dull reading, but Captain Hall and Lieutenant Nordhoff have written a book that will give pleasure not only to members of the Lafayette Flying Corps, but to their friends and to everyone who enjoys good reading and stirring adventure.

The first volume gives biographical sketches of the 216 men who were brevetted in the French service, and actually served at the front with the French Combat or Bombardment Squadrons; a brief history of the Corps from its organization until the transference of most of its members to the United States Air Service; reproductions of official documents dealing with the history of the Corps, and official lists of combats, casualties, prisoners, etc.

In Volume II an intimate history of the Corps is given by means of extracts from the men's letters, most of which have never before been printed. These extracts give an amazingly interesting and vivid account of the life of the American volunteers during their service with the French and constitute a fascinating story of one of the most striking phases of the War.

The two volumes contain over four hundred illustrations, including what is probably the most complete collection of photographs of the airmen's life at the front during the Great War that has ever been made. As a final and authoritative history of the Lafayette Flying Corps, published by the authority of the Executive Committee it will take a prominent place in the literature of the Great War.

Copies can be obtained at the Aeronautic Library, Inc., 299 Madison Ave., New York City—2 vols. Price $16.00 postpaid.

Propeller manufacture: After the propeller has been varnished and gone through the final drying process in a dust-proof room, further measurements are taken to make certain that the final tolerances allowed have not been exceeded in the slight warping which does take place. If the grain of the wood is properly slanted and alternated in the various laminations, this very minute deformation will be the same on each blade of the propeller, and the thrust balance will not in anywise be disturbed

Albert S. Burleson, Postmaster General
Otto Praeger, Second Assistant Postmaster General
Leon B. Lent, General Superintendent, Air Mail Service
D. V. Colyer, Chief of Flying
J. Clark Edgerton, Chief of Radio
Charles I. Stanton, Chief of Maintenance
George L. Conner, Chief Clerk

US
AERIAL MAIL

PILOTS

H. H. Rowe
J. P. Murray
C. V. Pickup
C. A. Braukman
S. S. Boggs
F. R. Yager
J. P. Woodward
B. M. Hefron
J. L. Mortensen
G. C. Black
Eric Springer
W. H. Jones
Ralph Watson
J. W. Sharpnack
J. L. Eaton
E. E. Mouton
W. L. Morgan
W. H. Williams
R. S. Little
K. M. Stewart
W. R. Holcomb
W. M. Barr
E. R. Vanatta
W. D. Williams
H. A. Chandler

P. W. Smith, Superintendent, New York-Chicago Division
E. W. Majors, Superintendent, Chicago-Omaha Division
A. R. Dunphy, Superintendent, Omaha-Salt Lake Division
John A. Jordan, Superintendent, Salt Lake-San Francisco Division
Carl Egge, Superintendent, Twin City-St. Louis Division
J. E. Whitbeck, Superintendent, New York-Washington Division
R. F. Holderman, Manager, Hazelhurst Field, L. I.
M. J. Kelly, Manager, Bellefonte, Pa.
H. M. Guerney, Manager, Cleveland, Ohio
S. M. Moore, Jr., Manager, Chicago, Ill.
H. S. Long, Manager, Iowa City, Iowa
H. L. Hartung, Manager, Cheyenne, Wyo.
W. I. Votaw, Manager, Omaha, Nebr.
G. R. Houston, Manager, Salt Lake City
O. A. Tomlinson, Manager, Reno, Nev.
Vern Hinkley, Manager, San Francisco
W. G. Witzel, Manager, St. Louis, Mo.
F. A. O'Leary, Manager, Washington, D. C.
C. A. Parker, Superintendent of Repairs, Bustleton, Pa.
E. W. Majors, Superintendent of Repairs, Chicago, Ill.

PILOTS

E. M. Allison
E. C. Davis
E. M. Haight
W. L. Carroll
Rufus Riddlesbarger
A. L. Jewett
L. H. Garrison
R. A. Reed
H. C. Brown
R. G. Jones
E. F. Baskey
Bryan McMullen
H. W. Cook
I. S. Amberg
E. Hamilton Lee
Robert H. Ellis
Randolph G. Page
Elmer G. Leonhardt
Walter J. Smith
Wesley L. Smith
James T. Christensen
Harry Huking
Clarence C. Lange
William C. Hopson

Investigation of Aerial Mail Accidents

A statement issued by the Post Office Department reads as follows:

"The investigation made by the Post Office Department as a result of recent accidents to J. L. Monoplanes has shown that the fires which caused the loss of the machines and the death of the occupants were the result principally of a defective gasoline feed system.

"There was, also, no provision for ventilating the fuselage or draining the bottom of the fuselage so that the leaking fuel could escape. It therefore collected beneath the engine and was ignited either by backfiring from the starved motor or by flames from the insufficiently protected exhaust manifold.

"'It was found that the engine ran at a very high temperature owing to the fact that the heavy vibration caused leaks in the radiator which quickly reduced the water supply, causing pre-ignition.

"Our experts have made the following recommendations, which were concurred in by experts of the Army Air Service after they had made an examination of the machines.

"That a scoop be devised for carrying a carburetor intake outside the fuselage.

"That gas lines be installed with flexible hose connections.

"That provision be made for draining the oil and gas drippings from the bottom of the fuselage and ventilating it.

"That a better quality of insulation for ignition system be installed to prevent short circuiting of the system and a discharge of sparks at various points in the engine compartment.

"These recommendations are being put into effect as rapidly as possible and the machines should be ready for flying again very shortly.

"There is no truth in the statement attributed to Mr. Larsen that the accidents to these machines were due to lack of ordinary care on the part of the Post Office Department employees. The accidents were, on the contrary, directly attributable to the defects pointed out above.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, July, 1920

DIVISION	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST						
													Gallons of Gasoline	Total Time Run hr.	min.	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
New York-Washington	$1,665.65	$240.29	$1,060.96	$910.02	$346.84	$1,531.98	$1,027.91	$2,924.64	$2,740.00	$782.51	$711.38	$13,942.18	5,101	207	33	15,751	3.1	$67.17	$0.89
St. Louis-Twin Cities	146.60	31.92	308.02	238.09	35.66	552.74	607.69	1,200.49	1,371.71	288.07	511.40	5,292.39	476	25	59	1,245	2.6	*203.68	*4.25
New York-Chicago	6,185.82	1,253.14	2,744.74	1,731.85	452.46	2,211.14	4,191.91	5,656.36	18,044.14	2,155.63	2,445.53	47,072.72	20,613	493	47	40,736	2.0	95.33	1.16
Chicago-Omaha	1,708.65	319.22	900.52	324.72	75.23	984.81	1,292.42	1,993.20	10,502.27	362.50	1,222.76	19,686.30	5,766	185	23	16,270	2.8	106.19	1.21
Totals and Averages	$9,706.72	$1,844.57	$5,014.24	$3,204.68	$910.19	$5,280.67	$7,119.93	$11,774.69	$32,658.12	$3,588.71	$4,891.07	$85,993.59	31,956	912	42	74,002	2.3	$94.22	$1.16

Planes operated on New York-Washington Division:
  Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
  Curtiss R4, equipped with Liberty 12 motors.
  Curtiss JN4D, equipped with Curtiss OX5 motors.
  De Havilands, equipped with Liberty 12 motors.
Planes operated on St. Louis-Twin Cities Division:
  Standard, equipped with Hispano-Suiza 8 motor.
  Curtiss JN4H, equipped with Hispano-Suiza 8 motor.
  De Haviland, equipped with Liberty 21 motor.
Planes operated on New York-Chicago Division:
  Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
  Curtiss R4, equipped with Liberty 12 motors.
  De Havilands, equipped with Liberty 12 motors.
  Twin De Havilands, equipped with 2 Liberty 6 motors.
  Martins, equipped with 2 Liberty 12 motors.
Planes operated on Chicago-Omaha Division:
  De Havilands, equipped with Liberty 12 motors.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington..	$0.24	$0.19	$0.46
St. Louis-Twin Cities....	1.11	.63	2.51
New York-Chicago......	.23	.29	.64
Chicago-Omaha.........	.18	.20	.83
Entire Service..........	$0.24	$0.25	$0.67

Note: *Excessive costs due to preparations preliminary to inauguration of service.

OTTO PRAEGER, Second Assistant Postmaster General.

THE PROBLEM OF THE TURBO-COMPRESSOR

By René Devillers, Ingénieur de L'Ecole Supérieure D'Aéronautique

Translated from the French by Paris Office, N. A. C. A.

(*Continued from page* 141)

Adaptation of a Supercharged Engine to an Aeroplane

Leaving for a moment the question of what manufacturers have succeeded in accomplishing up to date, we propose to bring out, in the following lines, as definitely and clearly as possible, what may be hoped for in the future superchargers.

THE PROPELLER.—We take an altitude Z for which the propeller will be determined; n is the number of revolutions at that altitude.

The compressor, assumed to be perfect, enables the engine to work at altitude Z in the same conditions as on the ground level. Let T be the motive power developed, equal to that given on the ground level at the same speed n.

The ratio $\frac{V}{nD}$ will still be designated by γ, V being the speed of advance of the aeroplane and D the diameter of the propeller. Also, let β be the coefficient of power of the propeller in the atmospheric conditions of the ground level and δ the relative density of the air.

We shall have:

$$T = \delta\beta n^3 D^5 \tag{37}$$

with

$$\gamma = \frac{V}{nD} \tag{38}$$

whence, by elimination of first D, then n:

$$\frac{n^2 T}{\delta V^5} = \frac{\beta}{\gamma^5} \tag{39}$$

$$\frac{\delta D^2 V^3}{T} = \frac{\gamma^3}{\beta} \tag{40}$$

As we indicated in the preceding chapter, we shall consider a family of propellers defined by the shape of the blade and differing from each other by the ratio of pitch to diameter. For each of them the values of the efficiency ρ in the function of γ (Fig. 375, p. 820 of original text) have been determined experimentally. The envelope of the efficiency curves will define the points of functioning to be adopted.

We have seen that with the best propellers having a ratio of 0.075 to 0.08 between width of blade and diameter, this enveloping curve may practically be represented by the equation:

$$\rho = 0.545 \sqrt[4]{10^2} \tag{41}$$

the speed V being expressed in kilometers per hour.

Assuming the law of proportionately of β to γ along this enveloping curve as given in the preceding chapter, we find that the efficiency attainable for each of these points and the corresponding diameter of the propeller are expressed as follows:

$$\rho = 0.54 \sqrt[16]{\frac{\delta V^5}{n^2 T}} \tag{42}$$

$$D = 1.04 \sqrt[4]{\frac{10^8 T}{\delta n^2 V}} \tag{43}$$

This theory shows that the equations relating to the propeller are the same as for an ordinary engine having a power $\frac{T}{\delta}$ on the ground level.

COMPARISON OF AN AEROPLANE WITH COMPRESSOR AND AN ORDINARY AEROPLANE OF THE SAME TYPE.—We will now compare two aeroplanes of the same type, one fitted with an ordinary engine and the other having the same engine with the addition of a supercharging device bringing the engine to ground level conditions at each altitude of flight considered.

The propeller of the supercharged engine will be determined for each altitude at a constant speed of rotation n, equal to that of the propeller of the ordinary engine. The power of the engine on ground level at this speed will be called T.

Write the general equations of the aeroplane, introducing a coefficient μ of decrease of power, equal to unity in the case of a supercharged engine. We shall have:

$$P = \delta K_y S V^2; \tag{44}$$

$$PBV = 75\rho\mu T; \tag{45}$$

$$\mu T = \delta\beta n^3 D^5; \tag{46}$$

$$\gamma = \frac{V}{nL} \tag{47}$$

As can be immediately verified, these equations show that the quantities:

$$\mu^2 \frac{\rho^3\beta}{\gamma^5}, \ \rho\mu\sqrt{\delta D^3} \frac{\rho\beta}{\gamma^5} \text{ and } \frac{V}{\mu\rho}$$

ARE THE SAME FOR THE TWO AEROPLANES WHEN THEY ARE FLYING AT THE SAME ANGLE

μ^2 ——,

OF ATTACK.

Therefore, for the non-supercharged engine, call:

μ_0, the coefficient of decrease of power for the altitude considered.

ρ_0, the efficiency of the propeller.

D_0, its diameter.

V_0, the speed of the aeroplane.

β_0 and γ_0, the values of β and γ.

For the engine fitted with a compressor the same quantities become 1, ρ_1, D_1, V_1, β_1 and γ_1. The altitude of flight corresponding to the angle of attack considered is then characterized by the value δ_1 of the relative density of the air. We shall therefore have:

$$\frac{\rho_1^3\beta_1}{\gamma_1^5} = \mu_0^2 \frac{\rho_0^3\beta_0}{\gamma_0^5} \tag{48}$$

$$\delta_1 = \mu_0^2 \delta_0 \frac{\rho_0^2}{\rho_1^2} \tag{49}$$

$$D_1^2 = D_0^2 \frac{\rho_0\beta_0}{\gamma_0^3} \frac{\gamma_1^3}{\rho_1\beta_1} \tag{50}$$

$$V_1 = \frac{V_0}{\mu_0} \cdot \frac{P_1}{\rho_0} \tag{51}$$

Propellers being always determined for the points of efficiency of the envelope of the curve, $\frac{\rho^3\beta}{\gamma^5}$ and $\frac{\rho\beta}{\gamma^3}$ are functions of efficiency perfectly determined for all these points.

Knowing the value of $\frac{\rho^3\beta}{\gamma^5}$ in the case of the ordinary engine, equation (48) gives the new value suitable for flying at the same angle of attack and the same speed of rotation of the propeller with the supercharged engine.

From this we deduce the efficiency ρ_1 and $\frac{\rho_1\beta_1}{\gamma_1^3}$.

The following relations (49, 50 and 51) then determine the altitude of flight, the diameter of the propeller, and the speed of the aeroplane.

The problem is thus completely solved by taking as a basis the results given by an aeroplane of the same type fitted with an ordinary engine.

Practical Formulas—We have seen that, for all the points used practically of the envelope of the efficiency curves of the best propellers, the efficiency ρ increases as the fourth root of γ and the coefficient of power β remains practically proportional to γ. Consequently, $\frac{\gamma^5}{\beta}$ varies as γ^4, that is, as ρ^{16},

Under these conditions formula (48) becomes:

$$\beta_1 = \frac{\rho_0}{\rho_0^{0.154}} \tag{52}$$

Equation (49), giving the altitude of flight, then becomes:

(53) $$\delta_1 = \mu_o^{2.3}\delta_o.$$

The coefficient of decrease of power μ_o is practically equal to the relative atmospheric pressure.

Taking δ and μ as equal to this pressure, we find the approximate correspondence:

(54) $$\mu_1 \mu_o^{3.3}$$

The current barometric law

(55) $$Z = 18{,}400 \operatorname{Log} \frac{1}{\mu}$$

then gives the practical relation, sufficient for a first analysis, between the altitudes.

(56) $$Z_1 = 3.3 Z_o$$

On the other hand, with the hypotheses made, $\frac{\gamma^3}{\beta}$ varies as γ^2, therefore as ρ^8.

Formula (50), indicating the correspondence between the diameters, becomes:

(57) $$D^1 = D_o \frac{\rho_1^{3.5}}{\rho_o^{3.5}} \frac{D_o}{\mu_o^{0.54}}$$

Lastly, the relation (51) between the speeds enables us to write:

(58) $$V_1 = \frac{V_o}{\mu_o^{1.154}}$$

As a conclusion we see that, for the aeroplane fitted with a compressor, THE EFFIENCY OF THE PROPELLER, ITS DIAMETER, AND THEREFORE THE RATIO OF PITCH TO DIAMETER, WILL INCREASE WITH THE ALTITUDE OF FLIGHT. On the other hand, the speed V_o of the reference aeroplane diminishing much less rapidly than μ_o, THE SPEED OF THE AEROPLANE ALSO INCREASES WITH ALTITUDE.

Assuming that power can be maintained constant at this altitude, we see that THE CEILING WILL BE ABOUT 3.3 TIMES THAT OF THE AEROPLANE FITTED WITH AN ORDINARY ENGINE.

Moreover, if we exceed the angle of attack corresponding to flight at he ceiling, we know that the speed V_o, the efficiency ρ_o and the altitude Z_o will diminish. We should then obtain, for corresponding flight with the compressor, a speed V_1, an efficiency ρ_1 and an altitude Z_1 which would also gradually diminish.

Under these conditions, the maximum speed V_1, which cannot be exceeded, would be obtained for the angle of flight at the ceiling.

The following table gives the results which would be furnished by a perfect compressor, compared with those furnished by an aeroplane fitted with an ordinary engine:

REFERENCE AEROPLANE		AEROPLANE WITH COMPRESSOR			
Altitude Z_o	Value of μ_o	$\frac{\rho_1}{\rho_o} = \frac{1}{\mu_o^{0.154}}$	$Z_1 = 3.3Z_o$	$\frac{D_1}{D_o} = \frac{1}{\mu_o^{0.54}}$	$\frac{V_1}{V_o} = \frac{1}{\mu_o^{1.154}}$
Meters			Meters		
1,000	0.89	1.02	3,300	1.06	1.14
1,500	0.83	1.03	4,950	1.10	1.23
2,000	0.78	1.04	6,600	1.14	1.33
2,500	0.74	1.05	8,250	1.18	1.42
3,000	0.69	1.06	9,900	1.22	1.54
3,500	0.65	1.07	11,550	1.26	1.65
4,000	0.61	1.08	13,200	1.30	1.77
4,500	0.57	1.09	14,850	1.35	1.91
5,000	0.53	1.10	16,500	1.40	2.0
5,500	0.50	1.11	18,150	1.45	2.23
6,000	0.47	1.12	19,800	1.50	2.39
6,500	0.44	1.13	21,450	1.56	2.58
7,000	0.41	1.14	23,100	1.62	2.79

As example, we take a Bréguet 14 A_2 fitted with a Renault 300 H.P. engine turning at 1,600 revolutions.

Tests with an ordinary engine gave the following results, the ceiling being at 6,000 meters:

Altitude Z_0	Speed V_0	Altitude Z_0	Speed V_0
Meters	km/h	Meters	km/h
0	180	4,000	163
1,000	177	5,000	155
2,000	174	6,000	140
3,000	170	(ceiling)	

By calculating as just indicated, the corresponding altitudes and speeds for the same aeroplane fitted with a perfect compressor and having the same speed of propeller, we obtain the following figures:

Altitude Z_1	Speed V_1	Altitude Z_1	Speed V_1	Altitude Z_1	Speed V_1	Altitude Z_1	Speed V_1
Meters	km/h	Meters	Meters	Meters	km/h	Meters	km/h
0	180	6,000	227	12,000	285	18,000	327
1,000	187	7,000	236	13,000	295	19,000	331
2,000	193	8,000	245	14,000	305	19,800	334
3,000	200	9,000	255	15,000	312	(ceiling)	
4,000	210	10,000	265	16,000	318		
5,000	220	11,000	275	17,000	323		

The diameter D_o is 2.94 meters, and the efficiency ρ_o is about 0.75 at $Z_o = 3{,}000$ meters. The efficiency ρ_1 will therefore practically be $1.06 \times 0.75 = 0.79$ at $Z_1 = 10{,}000$ meters, and the propeller should have a diameter $D_1 = 1.22 \times 2.94 = 3.58$ meters.

With a propeller of this dimension instead of 2.94 meters, the engine when near the ground level will turn at only a low speed on account of the drag of the propeller. The power of the engine being proportional to its speed, the take-off and climb would certainly be difficult. On the contrary, above the normal altitude of flight the engine would race as altitude increases.

We thus see that the utilization of a propeller, determined for horizontal flight at a certain altitude, may provoke the following phenomena:

(a) If the altitude chosen is too high, the aeroplane may not be able to get off the ground, or will do so with difficulty.

(b) If this altitude is low enough to enable the aeroplane to get off the ground easily, the engine will race at high altitudes.

With a propeller of variable pitch and diameter we could obtain a uniform speed of rotation and best efficiency for each altitude. If absolutely necessary, we might utilize a propeller of variable pitch only, but should lose in efficiency. The tests made up to date on such propellers have not been satisfactory, although the mechanical realization of the problem does not seem to be insurmountable.

Conclusions—It is only with a supercharged engine set designed for very high altitudes that the speed V_1 reaches interesting values of the order of 300 kilometers an hour. If, as in the case of the rateau turbo-compressor tested during the war, the ground level pressure is not re-established in the carburetor above 5,000 meters, no gain in speed is realized above that altitude. The best results obtained up to date in the flying tests at Villacoublay are as follows:

Altitude	Speed	
	Without Supercharging	With Turbo-Compressor
Meters	km/h	km/h
3,000	170	192
4,000	163	200
5,000	155	198
6,000	140	180
7,000	...	160

We see that we are still far from the results which may be given by a perfect turbo-compressor with the best adapted propeller at 5,500 meters. The maximum speed realized at an altitude of 4,500 meters is 205 kilometers an hour, while the greatest speed obtainable at the altitude, 5,500 meters, is about 215 kilometers an hour.

Before leaving this subject we may remark that the present-day aviation engines, constructed during the war, present a certain security in operation because they are almost always utilized at high altitudes; this has the effect of reducing mean pressure and, consequently, the stress on the parts.

If the torque were maintained constant at increasing altitude of flight, present-day engines would not be strong enough to withstand the strain.

THE MAXIMUM DISTANCE WHICH CAN BE COVERED BY AN AEROPLANE WITH COMPRESSOR.—We will assume that the initial altitude of flight is that for which the engine is in the conditions of working on ground level, and the flight is made AT CONSTANT ANGLE OF ATTACK.

From what has been established in the preceding chapter (p. 845 of original text), the efficiency of the propeller, assumed to be of invariable shape, is constant, as well as the coefficient of power β, and the speed of advance V is proportional to the number of revolutions n.

Formula (92) on p. 847 (of original text), established without any hypothesis as to the law of variation of power, is still applicable.

We may remark that, with respect to the similar ordinary aeroplane, we may obtain an appreciable gain on the distance covered, owing to the fact that the efficiency ρ is increased and that the specific consumption m must be smaller for an engine operating under ground level conditions than for one working at a pressure of reduced compression.

For an initial altitude of 3,000 meters for an ordinary aeroplane, the corresponding altitude for the second would be about 10,000 meters. Assuming a gain of 6 per cent on efficiency and a reduction of 12 per cent in specific consumption, we obtain a gain of 20 per cent on the distance covered.

There are, as for the ordinary aeroplane, two methods of making the flight:

1st. If we wish to maintain the CONSTANT SPEED OF ROTATION n and, consequently, the speed of advance V, the power must, at each instant, be reduced in proportion to the total weight. By equation of lift, the altitude will be known at each instant by the proportionality of the total weight to the density of the air.

2nd. If we wish to maintain CONSTANT ALTITUDE, the speed V and the number of revolutions will be reduced as the square root of the total weight. As in the first case, the engine torque must be reduced in proportion to the weight, which will have the effect of lowering the power in the proportion of 3/2 of the weight.

Formulas (116) and (130) of the preceding chapter (pp. 855 and 858 of original text), relating to the duration of flight, are applied, unity being substituted for the coefficient of decrease of power at the initial altitude.

Let us then compare two aeroplanes, one ordinary, the other with compressor, having at the start the same weight of gasoline in proportion to the total weight, and assuming the same specific consumption m and the same weight horsepower π. The first aeroplane begins its flight at a certain altitude where the coefficient of decrease of power is μ_0; the other takes the corresponding altitude at the same angle of attack. The duration of its flight is equal to that of the first aeroplane multiplied by the coefficient μ_0.

If we wish to determine the characteristics of the atmosphere at very high altitudes, we must abandon the law of Radau, generally admitted for the decrease of temperature, this law being insufficient for altitudes above 6,000 or 7,000 meters.

By numerous soundings, Professor Gamba, director of the Pavia Observatory, has found that up to 11,000 meters the temperature practically decreases according to a linear law of altitude. At altitude Z, the absolute temperature is T; according to these results, which agree with the most recent observations made in England and France, the THERMIC GRADIENT $G = \frac{dT}{dZ}$ would be constant up to 11,000 meters and practically equal to 6.5° per kilometer. Moreover, this law is, within a very little, that now accepted by English specialists.

Atmospheric Constants at High Altitudes

Altitude Z	Temperature T	Pressure H	Weight of Liter of Air a_z	$\mu = \frac{H}{760}$	$\delta = \frac{a_z}{a_0}$
Meters	Degrees C.	mm of Mercury	Grammes		
0	15	760	1,225	1	1
1,000	9	673	1.112	0.886	0.906
2,000	2	596	1.008	0.784	0.823
3,000	— 5	526	0.907	0.692	0.740
4,000	— 11	462	0.820	0.608	0.665
5,000	— 18	405	0.735	0.533	0.600
6,000	— 24	354	0.660	0.465	0.540
7,000	— 31	308	0.588	0.405	0.480
8,000	— 37	267	0.525	0.351	0.429
9,000	— 44	230	0.467	0.303	0.382
10,000	— 50	198	0.413	0.260	0.337
11,000	— 57	169	0.364	0.223	0.297
12,000	—	145	0.311	0.190	0.254
13,000	—	123	0.265	0.163	0.217
14,000	—	105	0.227	0.139	0.185
15,000	—	90	0.193	0.119	0.158
16,000	—	79	0,169	0.104	0.138
17,000	—	66	0.141	0.086	0.115
18,000	—	56	0.120	0.074	0.098
19,000	—	48	0.103	0.063	0.084
20,000	—	41	0.088	0.054	0.072

Above 11,000 meters, the observations made lead to the assumption of constant temperature, that is, a zero gradient.

Admitting these laws, we find for pressures and densities simple analytical forms in function of the altitude which are very convenient for certain computations.

Let dP be the differential of pressure, dZ the differential of altitude, and a_z the specific weight of the air.

We have:

$$(59) \qquad -dP = a_z dZ$$

The law of perfect gases gives us:

$$(60) \qquad a_z = \frac{P}{RT}$$

where R = 29.27 for the air. We shall thus have:

$$(61) \qquad -\frac{dP}{P} = \frac{dZ}{RT}$$

Let T_0 be the absolute temperature on the ground level. The gradient G being assumed constant, we have up to 11,000 meters:

$$(62) \qquad T = T_0 - GZ$$

from which, by immediate integration:

$$(63) \qquad \mu = \frac{P}{P_0} = \left(1 - \frac{G}{T_0} Z\right)^{\frac{1}{GR}}$$

On the other hand, the ratio of densities is:

$$(64) \qquad \delta = \frac{P}{P_0} \frac{T_0}{T} = \left(1 - \frac{G}{T_0} Z\right)^{\frac{1}{GR} - 1} = \mu^{1 - GR}$$

Taking the meter and kilogram as units and assuming a ground level temperature of 15° C.; G = 0.0065; T_0 = 288; R = 29.27; whence:

$$(65) \qquad \mu = \left(1 - \frac{0.0065}{288} Z\right)^{5.255}$$

$$(66) \qquad \delta = \left(1 - \frac{0.0065}{288} Z\right)^{4.255} = \mu^{0.81}$$

Above 11,000 meters the temperature is assumed to be uniform and of a value T_1. The pressure at 11,000 being P_1, formula (61) gives, by immediate integration:

$$(67) \qquad L \frac{P_1}{P} = \frac{Z - 11{,}000}{RT_1}$$

Taking T_1 = 273 —57 = 216, and passing to common logarithms, we have:

$$(68) \qquad \text{Log} \frac{P_1}{P} = \text{Log} \frac{\mu_1}{\mu} = \frac{Z - 11{,}000}{14{,}600}$$

With a ground level temperature of 15° C. the law of densities above 11,000 is:

$$(69) \qquad \delta = \frac{T_0}{T_1} \frac{P}{P_0} = \frac{288}{216} \mu = 1.33\mu$$

with

$$(70) \qquad \frac{a_z}{a_1} = \frac{P}{P_1}$$

As pointed out by M. Toussaint, it is interesting to compare the régime of temperatures in the atmosphere with the régime of the winds. Studying the results of numerous soundings, M. Ch. Maurain* has found that the mean velocity of the wind in clear weather increases regularly and in an almost linear fashion, from 5 meters per second at an altitude of 500 meters, up to 15.6 meters per second at 11,000 meters, then decreasing to about 8 meters per second at 19,000 meters.

The following table gives the atmospheric constants up to 20,000 meters, tabulated according to the foregoing hypotheses. It has been drawn up by M. Toussaint and has been proposed by him for the Standard Atmosphere.

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* *Minutes of the Académie des Sciences, July 15th,* 1919.

AEROPLANE PERFORMANCES AS INFLUENCED BY THE USE OF A SUPERCHARGED ENGINE

By **GEORGE DE BOTHEZAT**

Aerodynamical Expert, National Advisory Committee for Aeronautics

THE question of the influence of the use of a supercharged engine on aeroplane performance will be treated here in a first approximation, but one which gives an exact idea of the advantage of supercharging. The method used may be directly extended to treat this problem without any of the simplifying assumptions made. These assumptions are made exclusively to allow an easier survey of the problem.

Let us consider an aeroplane which climbs first with an ordinary engine, not supercharged, (called in the following case 1), and afterwards climbs with a supercharged engine (case II), and let us find the difference of the ceilings reached in the two cases.

We will assume in both cases the power a_{m0} of the motor at sea level to be the same and the efficiency η of the propeller to be maintained constant all the time. This is quite possible, to a certain extent for a propeller with an adjustable pitch, a conclusion reached by theory and experimentally verified.

In case I, we can consider in a first approximation the power a_m of the motor to be proportional to the density, that is, to be expressed in the form

$$a_m = m\delta \tag{1}$$

where δ is the air density at a given height H.

m a constant coefficient characteristic for the motor considered, assuming the number of revolutions of the motor to be kept nearly constant.

At sea level we have

$$a_{m0} = m\delta_0 \tag{2}$$

where δ_0 is the corresponding air density.

The power expended for horizontal flight at any altitude is equal to

$$a_n = \eta a_m = \eta m\delta = QV \tag{3}$$

where η is the propeller efficiency
Q the propeller thrust
V the flying speed.

On the other hand the equations of the horizontal steady motion are of the form

$$P = R_y = k_y\,\delta AV^2 \tag{4}$$

$$Q = R_x = k_x\,\delta AV^2 \tag{5}$$

where P is the total weight of the aeroplane

k_x and k_y the drag and lift coefficients (functions of the angle of attack only)

A the wing area.

Comparing (3) and (5), we find

$$QV = \eta m\delta = k_x\,\delta AV^3 \tag{6}$$

and following

$$\frac{\eta m}{A} = k_xV^3 \tag{7}$$

an equation that fixes the relation between the angle of attack i and the speed V for horizontal flight at any altitude in case I. I call *climbing curve (or C curve)* the curve of V plotted against i according to equation (7).

Let us now plot on a system of (V, i) axes the system of curves (see equation) (4)).

$$\frac{P}{\delta A} = k_yV^2 \tag{8}$$

for different values of δ. I call the last curves *velocity curves* (see figure). As the height H reached by an aeroplane is a direct function of δ (depending upon atmospheric conditions) for the curve (8) we can use H as parameter instead of δ. If we plot on the same (V, i) axes the C curve (7), each point of intersection of a velocity curve with the C curve gives for the height H corresponding to the velocity curve considered, the velocity V and the angle of attack i of the horizontal flight at the height H of the aeroplane considered. That velocity curve which is tangent to the C curve gives the value H_1 (case I) of the ceiling and the values of V and i corresponding to this ceiling.

The last value of the ceiling can also be found directly as follows: Eliminating V from (7) and (8), we find

$$\delta_1 = \frac{P^3{}_0{}^{2/3}}{A^{1/3}\eta^{2/3}a_{m0}{}^{2/3}}\left(\frac{k_x}{k_y{}^{3/2}}\right)^{2/3} \tag{9}$$

that is, the densit δ_1 (for case I) in function of the angle of attack i. The minimum value of δ_1 given by the last equation will correspond to the maximum of the height H that is, to the ceiling. Thus the value i_m of the angle of attack corresponding to the ceiling in case I will be found from the relation

$$\frac{d(\delta_1)}{di} = D \text{ or } \frac{d}{di}\left(\frac{k_x}{k_y{}^{3/2}}\right) = D$$

and

$$\delta_{1\,min} = \delta_1(i_m) \tag{10}$$

Practically, the best way is to plot the curve (9) and find its minimum graphically, because k_x and k_y are empirical functions.

It is easy to see that the angle of attack i_m, for which δ_1 is minimum, is the same angle for which the power δ_n expended for flight at sea level is minimum. In fact we have

$$a_n = QV = k_x\,\delta_0AV^3 \tag{11}$$

and replacing in the last equation V by its value taken from (8) we get

$$a_n = \frac{P^{3/2}}{A^{1/2}\,\delta_0{}^{1/2}}\;\frac{k_x}{k_y{}^{3/2}} \tag{12}$$

The minimum a_n takes place for an angle of attack given by

$$\frac{d(a_n)}{di} = D$$

that is

$$\frac{d}{di}\left(\frac{k_x}{k_y{}^{3/2}}\right) = D$$

which thus is the same angle i_m.

On the annexed figure are represented the velocity curves and the C_1 curve for a good actual aeroplane, as well as the δ_1 curve for case I, which curves fully illustrate all the foregoing. The ceiling is reached at an angle of attack of 13°, at a speed of 120 ft./sec. and has a value of 25,000 ft.

In case II we will have the power a_{m0} maintained constant by the supercharger, up to a certain altitude, say 20,000 ft., for example. Afterwards the power of the motor will again drop in a first approximation as the density. Let us first assume the limit possibility of

$$a_{m0} = \text{Const.}$$

up to any altitude.

Proceeding quite similarly to case I, we will find

$$a_n = \eta a_{m0} = QV = \text{Const} \tag{13}$$

following

$$QV = \eta a_{m0} = k_x\,\delta AV^3 \tag{14}$$

and dividing by (4) we get

$$\frac{\eta a_{m0}}{P} = \frac{k_x}{k_y}V \tag{15}$$

an equation which represents the curve in the limiting case II.

Plotting this C_{II} curve on the velocity curves, we will directly see the enormous increase of ceiling that a unlimited

(*Continued on page* 179)

AGREEMENT FORM FOR AERIAL LEAGUE OF AMERICA UNITS

AGREEMENT, entered into this ...... day of ...., 1920, between the Aerial League of America, Inc., PARTY OF THE FIRST PART, and .... PARTY OF THE SECOND PART: WITNESSETH.

WHEREAS, Party of the Second Part proposes to organize a Unit of the Aerial League of America to be known as the .... Unit of the AERIAL LEAGUE OF AMERICA and to act as CHAIRMAN of said UNIT: and

WHEREAS, said proposal is acceptable to PARTY of the FIRST PART:

NOW, THEREFORE, the parties hereto hereby agree as follows:

FIRST: PARTY OF THE FIRST PART hereby appoints party of the SECOND PART Chairmen of said Unit, with full power to organize and supervise the activities, and appoint the officers and chairmen of the committees of said Unit, hold meetings, invite and accept into the membership of the League, through the Unit, persons of either sex who qualify for membership in the League, as provided for in Article III of the By-laws of the League, which reads as follows:

ARTICLE III—MEMBERSHIP AND DUES

Sec. 1: Honorary Members shall be persons of either sex who have attained eminence through the promotion of aeronautics or who hold office in Federal, State, City or civil organizations, whose offices are so honored by the League. They shall not vote or hold office.

Sec. 2: Patrons shall be persons of either sex who have contributed One Thousand Dollars ($1,000.00) to the objects of the League. They shall be entitled to all the privileges of membership for life.

Sec. 3: Supporting members shall be persons of either sex who have contributed Two Hundred and Fifty Dollars ($250.00) for the advancement of the objects of the League. They shall be entitled to all the privileges of membership for life.

Sec. 4: Fellow shall be persons of either sex, engaged in scientific work pertaining to aeronautic and allied sciences and commissioned officers in the U. S. Army, Navy and National and Reserve Forces. They shall pay annual dues of $15.00 and $100.00 for life membership.

Sec. 5: Army and Navy Members shall be officers of the United States Army and Navy, National and Reserve Forces. They shall pay annual dues of $5.00 or $75.00 for life membership.

Sec. 6: Members shall be persons of either sex, over 18 years of age, who are interested in the objects of the League. They shall pay annual dues of $10.00 or $100.00 for life membership.

Sec. 7: Associate (Junior) Membership shall be persons of either sex who are under 18 years of age. They shall pay annual dues of $5.00. They shall not vote or hold office.

Sec. 8: Affiliated Members shall be persons of either sex who belong to Aerial League of different countries, states, or cities ,which are affiliated with the Aerial League of America. They are entitled to all the privileges of membership.

Sec. 9: Advisory Members shall be persons of either sex prominent in different calls of life, such as engineers, lawyers, insurance experts, or doctors, who will represent the League in their respective localities and to whom will be referred by the League cases that may arise in their localities where their expert knowledge and advice is desired. They shall pay $25.00 a year.

SECOND: PARTY OF THE FIRST PART also authorizes PARTY OF THE SECOND PART to represent the League, directing the activities of the said Unit of the Aerial League of America in accordance with the object of the League, as defined in Article II of the by-laws, which read as follows:

The objects of the Aerial League of America are as follows:

Sec. 1: (a) To be a national organization through which patriotic men, women, boys and girls can assist in the work or securing the aerial supremacy which is necessary for the maintenance and protection of our national institutions by assisting in educating the Nation to its aeronautic task.

(b) To evolve plans for the employment of aircraft for civil and commercial purposes so that our ex-Army and Navy aviators may have employment.

(c) To make known generally the Aerial Transportation through eliminating frontiers and bringing people of different nations into closer contact—as fast transportation always has done—promises to become the most important factor in developing cordial relations between nations.

(d) To co-operate in establishing airways and air routes and promote and encourage in all ways the construction of aerodromes, stations and aircraft landing places, and other facilities for air travelers.

(e) To co-operate in securing national and international legislation and the formation of proper rules and regulations to govern aerial navigation and to protect the interest of owners and users of aircraft against unjust and unreasonable legislation, and to maintain the lawful rights and privileges of owners and users of all forms of aircraft whenever and wherever such rights and privileges are menaced.

(f) To promote original investigation and development of every branch of science and art of aeronautics.

(g) To hold conferences, meets and events intended to create public interest in aeronautic.

(h) To do everything necessary, suitable and proper for the accomplishment of any of the purposes or the furtherance of any of the powers hereinbefore set forth, and to every other act incidental or appurtenant to or connected with the aforsaid powers or parts thereof.

Sec. 2: The Aerial League of America shall be essentially a member's organization, supported by members' subscriptions and not carried on for profit.

THIRD: Party of the First Part agrees to allow to the said Unit of the Aerial League of America, to be retained in the Treasury of the Unit and be spent as may be directed by the Executive Committee of the Unit, twenty-five per cent of the membership dues paid by members of the Unit. The Unit shall also be entitled to all moneys collected by the Unit outside of membership dues.

FOURTH: Party of the Second Part agrees to

(1) To endeavor to select ten people within thirty days who will become FELLOW members of the League through the Unit and will act as temporary or permanent officers and chairmen of committees of the Unit, thus organizing the Unit;

(2) To endeavor to increase the membership of the Unit until there is a chairman for every committee, each chairman to be a person who has qualified as a Fellow Member of the League by payment of $15.00;

(3) To endeavor to induce the chairman of each committee to secure at least two members for his committee during the next sixty days. Said members may be regular, Fellow or Advisory members, as they may elect.

(4) To arrange for a meeting place for the Unit and have an aeronautic reference library which can be consulted by the members of the Unit;

(5) Immediately upon receiving remittance of $112.50 from Party of the Second Part, covering ten fellow membership at $15 each, less 25/100, Party of the First Part will send to Party of the Second Part the ten membership cards and buttons and an Aeronautic Reference Library consisting of the following books, for which no charge will be made:

Name	Selling Price
Textbook of Applied Aeronautic Engineering	$6.00
Textbook of Naval Aeronautics	6.00
Textbook of Military Aeronautic	6.00
The Aero Blue Book	6.00
Textbook of Aerial Laws	8.00
Textbook of Aero Engines	10.00
Aeroplane Construction and Operation	2.00
Principles of Aerography	4.00
Textbook of Air Medical Science (valued at $10. but is not for sale)	
Wall map of the U. S. and Canadian Airways	5.00
Wall Map of World's Airways	5.00
Back numbers of Aerial Age Weekly from October, 1919, up to date	10.00
Back numbers of Flying from October, 1919, up to date	5.00

IN WITNESS WHEREOF: parties hereto and hereunto set their names the day and year first above mentioned,

AERIAL LEAGUE OF AMERICA, INC.

New York, N. Y.
1920

By: ____________________

Witness____________________

____

ORGANIZATION PLAN FOR THE UNITS OF THE AERIAL LEAGUE OF AMERICA

Units will adopt the name of the community, university, institution or organization where they are organized. Officials and members of Units are members of the Aerial League of America and are entitled to all the privileges of membership in the Aerial League of America, in addition to which they assume the name of the Unit, as for instance, the chairman of the Boston Unit is designated as "The chairman of the Boston Unit of the Aerial League of America," etc.

Name of Unit..

Name of Chairman of Unit..

Address of Chairman..

Address of Meeting Place and Aeronautic Library..

What day of the week or month are regular meetings of the Unit to be held?..

On what days and hours can members of the Unit call at Unit's Aeronautic Library to borrow or read books and periodicals? ....

Names and Address of Vice-Chairman and Secretary of the Unit:

	Name	Address
First Vice-Chairman		
Second Vice-Chairman		
Third Vice-Chairman		
Fourth Vice-Chairman		
Executive Secretary		

Regular Meetings of the Members of the Unit: The Unit shall hold regular weekly, semi-monthly or monthly meetings on days and hours set by the Executive Committee of the Unit, which shall so arrange its schedule as to insure having at each meeting the report of one or more of the Committees of the Unit, with discussions of the subjects presented. As the Committees make periodical reports on the progress of the branches of aeronautics of which they are in charge and the dates for presenting their reports is to be fixed by the Executive Committee, in the event that weekly or monthly meetings of the Unit are held, there will be one or more Committee reports presented and discussed at each meeting.

The Executive Committee may, at its discretion, invite authorities and officials to attend the meetings as the guests of the Unit. What other cities throughout the world are doing aeronautically will interest the Mayor, the City Commissioners, the Postmaster, the Judges, the Sheriff, the Chief of Police, the City Planning Commission, the Station Master and other officials; and the progress in aeronautic insurance will interest the insurance experts, the medical aspects of aeronautics will interest the progressive M.D.s, the introduction of aircraft and air features in films, plays, and aeronautic songs, poetry, literature and art will be of interest to many people, the technical development of aircraft and motors will interest engineers, the equipment for and problems of night flying will interest electrical experts, the evolution of aerial laws will interest lawyers, etc., etc.

NAMES AND FUNCTIONS OF COMMITTEES

(1) **Executive Committee:** The Chairman of the Unit, who has been appointed by the President of the Aerial League of America, shall be the Chairman of the Executive Committee of the Unit, which Committee includes the First, Second, Third, and Fourth Vice-Chairmen, and may be increased at the discretion of the Chairman of the Executive Committee. The Executive Committee shall have charge of all affairs of the Unit. The Chairman of the Executive Committee shall be ex-officio member of all committees.

The Executive Committee shall appoint the Chairmen of all committees, which shall consist of a Chairman, a Vice-Chairman and such number of additional members, and to have such powers as the Executive Committee may from time to time determine.

The Executive Committee shall meet at the call of the Chairman and shall keep the minutes of its proceedings, make a report at each annual meeting and perform such other duties as by resolution it may from time to time adopt.

The committees of the Unit shall perform the duties herewith outlined and such other duties as by resolution the Executive Committee may direct.

(2) **Board of Trustees:** The Executive Committee may, at its discretion, elect a Board of Trustees, composed entirely of members who shall have paid or pledged $500 or over to the objects of the Unit. Said trustees will become members of the Executive Committee of the Unit upon payment of their pledges or may be elected "patron" members.

(3) **Honorary Chairman, Vice-Chairman and Members:** The Executive Committee may also elect an Honorary Chairman, six Honorary Vice-Chairmen and six Honorary Members, who shall be persons of either sex who have attained eminence through the promotion of aeronautics or who shall have made important contributions toward the support, expansion of activities and success of the Unit, or who hold office in federal, state, city, or civil organizations.

(4) **Finance Committee:** The Finance Committee shall have charge of the finances of the Unit, subject to instructions from the Executive Committee.

Name of Chairman..

Address ....

(5) **Membership Committee:** The Membership Committee shall have charge of the finances of the Unit, subject to instructions from the Executive Committee.

Name of Chairman..

Address ....

(6) **Aeronautic Library Committee:** It shall be the duty of this Committee to maintain an up-to-date Aeronautic Library, equipped with the necessary books and periodicals to supply the chairmen and members of the other committees with the information necessary to make their reports. The Aeronautic Library of the Unit may be located at the headquarters of the Unit, which may be in the office or home of one of the officials or in one of the Clubs. The Executive Committee of the Unit may decide to turn the Aeronautic Library into a source of revenue by selling books, periodicals, maps, and aeronautic novelties and conducting a circulating aeronautic library, charging fees for loaning books, the proceeds from which will go to the Unit. In such a case the Aeronautic Library may be established in a shop or office, whichever the Executive Committee may decide. Plans for establishing and operating an aeronautic library at a profit can be obtained from the Aeronautic Library, Inc., 299 Madison Avenue, New York City.

A well operated Aeronautic Library costing little over $100 will make the Library a center of aeronautic activities, attract many people and do much to increase the membership of the Unit and to make the Unit the advisory body for people interested in aeronautics in your community.

Name of Chairman..

Address ....

(7) **Military Aeronautic Committee** shall follow the progress of the application of aircraft for military purposes throughout the world and report periodically on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(8) **Naval Aeronautics Committee** shall follow the progress of the application of aircraft for naval purposes throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(9) **Aerial Mail Committee** shall prepare plans for establishing aerial mail routes to the community represented by the Unit and shall follow the progress of the application of aircraft for aerial mail carrying throughout the world, and report periodically on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(10) **Air Travel and Transportation Committee** shall follow the progress of the application of aircraft for the purpose of air travel and transportation throughout the world and report periodically on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(11) **Airports and Emergency Landing Committee** shall make plans for establishing an airport and emergency landing places in the community and follow the progress made in establishing airports and landing places throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(12) **Aerial Touring Committee** shall follow the progress of the application of aircraft for the purpose of aerial touring throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(13) **Marine Flying Committee** shall follow the progress of marine flying throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(14) **Aerial Coast Guard and Life Saving Service Committee** shall follow the progress made in the application of aircraft for coast guard and life saving purposes throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(15) **Airship (Dirigible) Committee** shall follow the progress made in the construction and operation of airships (dirigibles) throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(16) **Aeroplane Improvements Committee** shall follow the progress made in the technical improvements of aircraft throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(17) **Aero Engines Committee** shall follow the progress made in improving aero engines throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(18) **Airways and Air Routes Committee** shall follow the progress made in the establishing of airways and air routes throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(19) **Aeronautic Maps Committee** shall prepare maps of the locality, showing all open places affording runways of from 400 feet upward for aircraft, and shall follow the progress in the making of aeronautic maps throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(20) **Aerial Police and Public Safety Committee** shall assist the authorities in organizing aerial police reserves and enforcing measures necessary for public safety where aircraft are operated; and shall follow the progress made in the organization of aerial police forces and measures adopted for public safety throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(21) **Night Flying Committee** shall follow the progress made in night flying throughout the world, the lighting equipment adopted for aircraft and airports in different countries, problems to be solved, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(22) **Aerial Laws and Regulations Committee** shall follow the progress in making aerial laws and regulations for aerial navigation throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(23) **Aeronautic City Planning Committee** shall follow the progress in employing aircraft to assist in city planning throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(24) **Practical Uses of Aircraft Committee** shall follow the progress made in the use of aircraft for commercial and general utilitarian purposes throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(25) **Aeronautic Insurance Committee** shall follow the developments that take place in the field of aeronautic insurance, methods employed to define risks, premiums charged, methods of adjusting claims, etc., throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(26) **Air Medical Standards Committee** shall follow the progress made in the establishing of air medical standards and increase of knowledge of the medical aspects of flying throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(27) **Aero Photography Committee** shall follow the progress made in the application of aero photography for city planning, surveying and mapping, and improvements in aeronautic photographic equipment throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(28) **Aerial Exploration and Surveying Committee** shall follow the progress made in the application of aircraft for exploration and surveying throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(29) **Aeronautic Instruments Committee** shall follow the progress made throughout the world in producing and improving instruments needed for aerial navigation and to improve the operation of aircraft, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(30) **Aeronautic Literature Committee** shall follow the growth of aeronautic literature as a whole, including the introduction of aeronautic topics in contemporary fiction and poetry throughout the world and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(31) **Aeronautic Art Committee** shall follow the progress of aeronautic subjects in drawings, painting and sculpture throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(32) **Aeronautic Music and Drama Committee** shall follow the growth of aeronautics in music, drama, motion pictures, and plays throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(33) **Aero-Astronomy Committee** shall follow the application of aircraft to the study of astronomy throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(34) **Aircraft Advertising Committee** shall follow the growth of the use of aircraft for advertising purposes throughout the world, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(35) **Contest Committee** shall have charge of conducting all the contests organized by the Unit or by other organizations, in which the Unit participates, and report periodically, on dates decided by the Executive Committee.

Name of Chairman..

Address ....

(36) **Public Education Committee** shall have charge of issuing statements and reports for publication, subject to instructions from the Executive Committee.

Name of Chairman..

Address ....

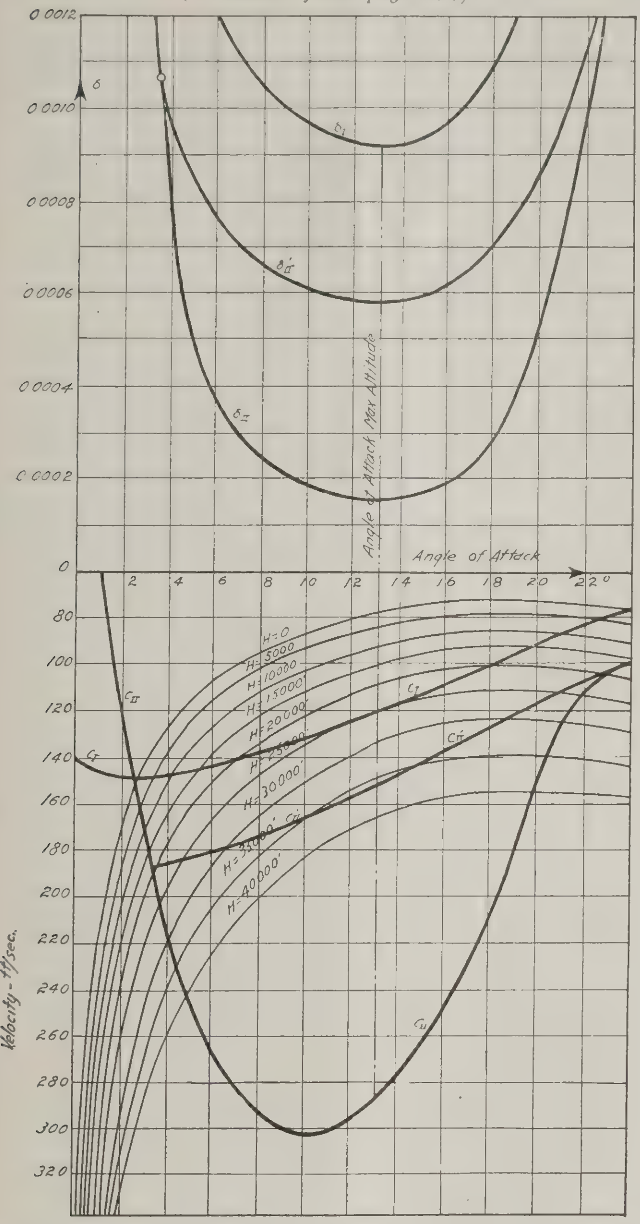
(37) **Entertainment Committee** shall have charge of arranging the entertainments and meetings of the Unit, subject to the instructions of the Executive Committee.

Name of Chairman..

Address ....

For further information write to the Secretary, Aerial League of America, 280 Madison Avenue, New York City.

(Continued from page 174)



supercharging would give. The fact to be noted is that even in the case of an unlimited supercharging we reach a ceiling.

In this last case the density curve has for expression

$$\delta_{11} = \frac{P}{A\eta^3 a^2_{m0}}\left(\frac{k_x}{k_y{}^{3/2}}\right)^2 \qquad (16)$$

and its minimum, corresponding to the ceiling, takes place for the same angle of attack i_m as in the preceding case.

$$\delta_{11\min} = \delta_{11}(i_m) \qquad (17)$$

But the supercharging maintains the power only up to a certain altitude, and after this altitude is reached the power of the motor will vary according to the law

$$a_{mc} = m_c\delta \qquad (18)$$

where the value of m_c has to be taken from the relation

$$a_{m0} = m_c\delta_c \qquad (19)$$

δ_c being the density at the limit height up to which the supercharger maintains the power. The aeroplane will start to climb from this altitude as if δ_c were the sea level.

After the density δ_c has been reached, there must accordingly arise a sudden change in the course of the C_{11} curve. Its second branch C^1_{11} will be given, as is easy to see, by the relation

$$\frac{\eta_{mc}}{A} = k_x V^3 \qquad (20)$$

and the corresponding δ^1_{11} density curve will be

$$\delta^1_{11} = \frac{P\delta_c{}^{2/3}}{A^{1/3}\eta^{2/3}a_{m0}{}^{2/3}}\left(\frac{k_x}{k_y{}^{3/2}}\right)^{2/3} \qquad (21)$$

and its minimum takes place, as it is easy to see, for the same angle of attack i_m, which minimum fixes the value of the ceiling in this last case of supercharging.

$$\delta_{11\min} = \delta_{11}(i_m) \qquad (22)$$

The C^1_{11} curve and the C_{11} curve necessarily intersect on the velocity curve

$$\frac{P}{\delta_c A} = k_y V^2 \qquad (23)$$

corresponding to the value a_c of the density up to which the supercharging maintains the motor power.

In the case of our figure the ceiling from 25,000 ft. is increased to 37,000 ft., the supercharging maintaining the power only up to 20,000 ft. This makes, in comparison with case I of an engine without supercharging, an increase of the ceiling of about 50 per cent.

We thus see the whole importance of engine supercharging, which has for general result so sensible an increase of ceiling.

Plans of Aeromarine West Indies Airways Announced

The Aeromarine West Indies Airways, Inc., will operate a fleet of six seaplane cruisers carrying both passengers and mail, according to a statement from the company. Under the contract recently signed with the Post Office Department a daily service must be maintained. Five hundred pounds of mail will be carried to and from Cuba every day.

"The company has contracted to depart for Cuba within thirty minutes after the arrival of the northern mail," the company's announcement says. "It is estimated that the mail deliveries will be advanced twenty-four hours. Whereas it takes all night for boats to make the trip, the Aeromarine flying boats will negotiate the distance in a little more than an hour.

"The planes are equipped with ventilators, open port holes, smoking compartments and buffets. There are two cabins fore and aft, connected by a passageway. The planes are furnished in mahogany and silver trimmings, and are equipped with radio. The aero marine flying boats are powered with two 400 horse power motors, giving them an average of eighty nautical miles an hour. They have a wing spread of 104 feet."

The operating staff is under the management of Geoffrey H. Bonnell, a former major in the Royal Air Force. The machines will be launched at Keyport, N. J., probably next week, and be flown to their station at Key West, Fla. The hangars and repair shops there have been completed, and those at the Havana terminus are nearly so.

Personal Par

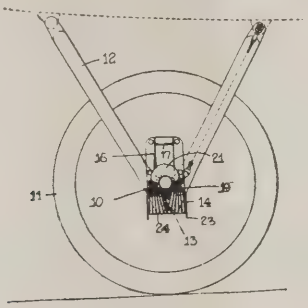
Charles T. Porter, formerly with the Naval Aircraft Factory, Philadelphia, Pa., is now associated with the Huff, Daland & Co., Ogdensburg, N. Y.

Army Aeroplane Board Named

Col. Chalmers G. Hall, Maj. Horace M. Hickam and Capt. Harold E. Hartney, air service, United States Army, have been appointed a board to meet with a similar naval board in Washington to discuss sales of aeronautical equipment to foreign governments and to nationals of foreign countries with a view to reaching an agreement on such points of difference regarding such sales as may exist between the War and Navy departments.

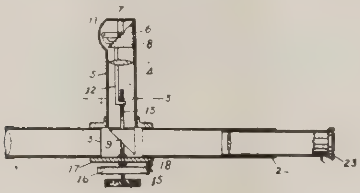
RECENT AERO PATENTS

1,336,633. LANDING-GEAR FOR AIRCRAFT. Henry Kleckler, Buffalo, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, a Corporation of New York. Filed Jan. 30, 1918, Serial No. 214,540. 15 Claims. (Cl. 244—2.)



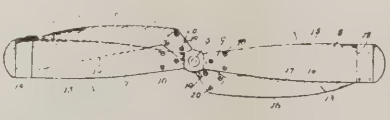
1. In a landing gear for aircraft, spaced landing gear struts, a cross connection between the struts, shock absorber elastics laced transversely beneath the struts and over the cross connection, guides for the cross connection rigidly supported at the foot of the struts, and means on the cross connection and engaging the guides to prevent axial displacement of the cross connection.

1,339,006. AEROPLANE HEIGHT-INDICATOR. Lawrenc B. Sperry, Brooklyn, N. Y., assignor to The Lawrence Sperry Aircraft Company, Inc., New York, N. Y., a Corporation of New York. Filed July 13, 1917. Serial No. 180,268. 7 Claims. (Cl. 88—2.7.)



1. An instrument for measuring the height of aeroplanes, comprising means for observing the horizon on one side; means for observing the horizon on the opposite side; means for alining the images of both of said horizons, and means connected with said alining means for indicating the height of the aeroplane.

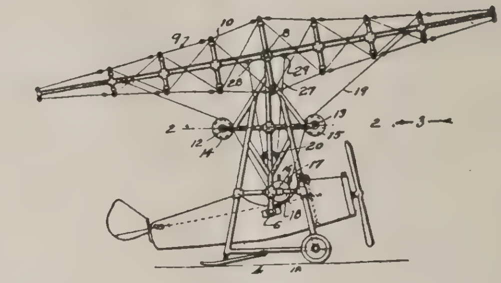
1,338,874. AEROPLANE-PROPELLER. Richard M. Shaffer, Baltimore, Md., assignor of one-fourth to Charles B. Mann and one-fourth to Charles B. Mann, Jr., Baltimore, Md. Filed Sept. 20, 1917. Serial No. 192,278. 8 Claims. (Cl. 170—171.)



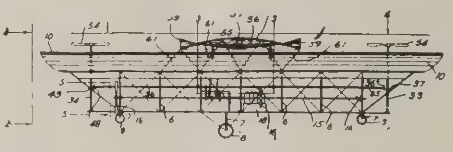
8. An air-craft propeller having a plurality of main blades and each main blade having an inclined bracing blade at the side thereof, each bracing blade being shorter than the main blade and having its outer end secured against the flat side of the main blade it braces and the inner end of each shorter bracing blade extending rearwardly of the main blade it braces.

1,336,678. AEROPLANE. Bert Carlisle, Santa Ana, Calif. Filed Jan. 14, 1919. Serial No. 271,098. 2 Claims. (Cl. 244—29.)

1. In a flying machine a main body; side frames extending upwardly from the main body; a lifting plane pivotally mounted at the upper ends of the side frames; a tiller mounted near the lower ends of the side frames; a pulley rigid with the tiller; guide pulleys above the tiller shaft; a cable extending under the tiller pulley and upwardly over the guide pulleys and having both ends attached to the lifting plane; the points of attachment of the cable to the lifting plane being twenty-four feet each side of the center of the pivot of the lifting plane and the level of the guide pulleys being twelve feet below the level of the lifting plane pivot and the guide pulleys being seven feet each side of the vertical center; and the diameter of the guide pulleys being eighteen inches; so that when the tiller is operated the cable will remain taut to tilt the lifting plane to any desired angle in either direction.

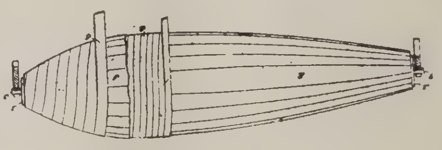


1,339,336. FLYING-MACHINE. George R. Henry, Denver, Colo. Filed Dec. 22, 1917. Serial No. 208,364. 7 Claims. (Cl. 244—12.)



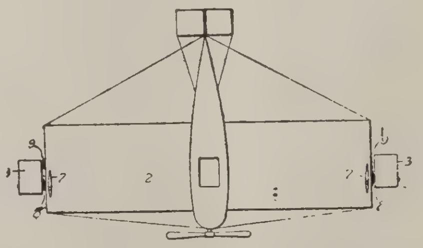
4. A flying machine, including a main wing whose length is several times greater than its width, its length being longitudinally disposed with respect to the direction of flight, and a stabilizing wing whose length is greater than its width, the said stabilizing wing being spaced from the main wing and having its length disposed at right angles to the direction of flight, said stabilizing wing having a central depression, the side and end portions of the wing being bowed vertically between their extremities.

1,338,564. FUSELAGE. Armin Elmendorf, Madison, Wis. Filed Jan. 19, 1920. Serial No. 352,366. 5 Claims. (Cl. 244—30.)



1. A fuselage comprising a hollow body formed of a plurality of veneer plies, the inner placed longitudinally, the second, circumferentially, and the third longitudinally of the fuselage.

1,334,707. AERODYNAMIC STABILIZER. James V. Martin, Detroit, Mich. Filed May 11, 1916. Serial No. 96,749. 28 Claims. (Cl. 244—29.)



23. A symmetrical double convex aileron having its greatest camber approximately one-third the distance of its cord from the leading edge of the aileron.

NAVAL and MILITARY AERONAUTICS

Air Service R. O. T. C. Units

The establishment of a limited number of Air Service R. O. T. C. units has been authorized by the War Department. Maj. Gen. Charles T. Menoher, U. S. A., Chief of the Air Service, has forwarded invitations to certain educational institutions to make application for such units, from which it is expected to create a reservoir of officer material for the Air Service. In addition it is believed that by the adoption of this policy, which was discussed by General Mitchell and staff before the Senate and House Committees on Military Affairs at the last session of Congress, there will be created an added interest in aviation among the young students of this country. Regulations concerning courses of training, equipment and other features for these units will be furnished to the corps area commanders as soon as approved by the War Department. It is expected that the courses of training will consist of military instruction and technical aeronautical engineering. Practical Air Service training at the educational institutions will be limited to ground instruction, although there is a desire on the part of some well-known Eastern universities to be permitted to give a complete course, which would include actual flying. General Menoher is making every effort to obtain the co-operation of the institutions most adapted to the formation of these units. Because of the embryo stage of the plan general applications are not desired this year.

The U. S. Airship R-38

The Navy Department announced on September 22 that latest reports from the officers in charge of the construction of the R-38 at Bedford, England, state the airship will be completed within the next two months. It is not expected that the voyage to the United States will be made before May, 1921. At that time the hangar at Lakehurst, N. J., will be ready to receive the giant dirigible. With the completion of the Lakehurst hangar, the United States will be in the position to construct airships similar to the R-38. At the present time the English hangar is the only one in the world in which such a large dirigible could be built. The R-38 as well as the Lakehurst hangar are the largest of their kind in the world. The latest figures on the R-38 give the following facts: Length, 694.5 feet; diameter, 85.5 feet; useful lift, 45 tons; fuel capacity, 32 tons (13 tons available for freight personnel, etc.); consumption per hour, 180 gallons; cruising radius, 5,600 knots; speed, 60 knots; speed, cruising, 50 knots; complement, 6 officers, 19 men; motors, 6 Sunbeam Cossack, 350-horsepower; gas volume, 2,724,000 cubic feet hydrogen; dead weight, 33 tons.

Navy Asks Army for Hangar Space

Because of the complications arising when the U. S. Navy made plans to erect a large hangar to accommodate rigid dirigible ballons on North Island, San Diego, Cal., the Aeronautical Board has recommended that the War Department deed to the U. S. Navy an available portion of March Field, Riverside, Cal., now used as a pilots' school by the Army Air Service. It is proposed that an inspection be made by a joint board of Army and Navy officers with the purpose of settling upon the location for the Navy hangar. It is evident from the recommendation of the Aeronautical Board that the Navy Department is not disposed to contest in the courts the ownership of North Island.

Weather Delays Air Service Nome Expedition

The elements continue to be unfavorable for the Army Air Service New York to Nome and return expedition's flight home. Lieut. Ross C. Kirkpatrick, U. S. A., in Machine No. 4, who was favored by fortune in getting away from Wrangell, B. C., ahead of the three other machines of the squadron, telegraphed from Jasper, B. C., to headquarters, Air Service, Washington, D. C., on September 23: "Arrived at 6:45 p. m. from Prince George, B. C.; time, three hours and ten minutes. Rain storms 300-foot ceiling. Followed G. P. P. tracks." The flying distance from Prince George to Jasper is 200 miles. On the same date headquarters received the following message from Capt. St. Clair Street, U. S. A., commanding the expedition, sent from Telegraph Creek, B. C.: "Three planes stored at Glenora. Ready to go when weather permits. Have hopes for tomorrow. Barometer rising. Weather has been generally bad throughout the entire section. So far from town unable to get regular wires through." The landing field is nearly five miles from the telegraph station at Telegraph Creek. The next dispatch, dated September 25, also from Telegraph Creek, brought no better news. Captain Street said: "Weather still bad along line. Barometer rising. Still have hopes for tomorrow. Planes and men O.K." The next message from him was dated September 28. He was then still at Telegraph Creek. He wired: "Unable to get away. Barometer has gone up to thirty. Promise of flying weather tomorrow. Have had no late word from Kirkpatrick." On September 30 headquarters received the following message from Captain Street, dated Hazelton, B. C., September 29: "Three planes arrived here at 6:05 p. m. after four hours and ten minutes in the air. Lieutenant Nutt broke landing gear and propeller in soft field. Am wiring Wrangell for parts to replace those broken." On the same day this dispatch was received from Lieutenant Kirkpatrick, who was then at Saskatoon, Canada, on September 29: "Plane 4 arrived Saskatoon from Edmonton, Alberta, 5 p. m. Time, three hours and thirty-five minutes. Ideal weather."

Appropriations for Langley Field Hangars

The Secretary of War has authorized that $46,450 be expended in building additions to the hangars at Langley Field, Hampton, Va. The Quartermaster General has been directed to proceed with the work at once.

Air Service Headquarters Moves

The office of Chief of Air Service is now located in the War Department Munitions Building, 19th and B Streets, Washington, D. C. The headquarters and its entire personnel, since early in 1917 lolated in the temporary buildings at 7th and B Streets, expect to be permanently located on the third floor of the Munitions Building when the transfer has been completed.

Air Service Headquarters Personnel

Recent orders affecting personnel on duty in the office of the Chief of Air Service included the following: Major Walter H. Frank assigned to duty as assistant to executive. Major Herbert A. Dargue assigned to duty with the Advisory Board. Major John D. Reardon, in addition to his other duties, detailed as an additional member of the Advisory Board. Major Jacob E. Fickel relieved as Chief of Finance, Contract Division Supply Group, detailed as permanent working member of the Advisory Board. Capt. Maxwell L. McCullough assigned to Information Group. Capt. Hubert V. Hopkins, in addition to his other duties, designated as Air Service officer to take over the work of classification of officers. Lieut. Rene R. Studler designated liaison officer between office Chief of Air Service and the Adjutant General's office for duty in connection with recruiting. Lieut. Wilbur T. Emerson appointed chief of Finance Contract Division, Supply Group.

Minnesota Organizes Observation Air Squadron

To call attention to the fact that Minnesota has organized an observation squadron in the National Guard which is now asking Federal recognition and to demonstrate to the War Department their interest, Major W. C. Garis and Captain Ray S. Miller, pilot, of the Minnesota National Guard, flew to Washington from the "Twin Cities," Minneapolis and St. Paul, making the trip to New York in twelve hours and twenty-three minutes, flying time, and from New York to Washington in three hours and forty-five minutes against heavy head winds.

Minneapolis and St. Paul have a joint municipal field near Fort Snelling, the two and one-half mile oval of the former automobile speedway.

Examining Board

The following named officers will constitute a board for the examination of such applicants as will be ordered to appear before it by the Chief of Air Service, to determine their mental, moral and physical fitness for future appointment as second lieutenants in the Officers' Reserve Corps: Major Walter Vautsmeier, Capt. A. W. Smith, Lieut. F. B. Wieners and Lieut. Laughinghouse.

FOREIGN NEWS

A New German Air-Port

According to a message from Bremen a sum of 11,000,000 marks (about $240,000 at present rates of exchange) has been subscribed for the establishment of an air-port in that city. The establishment will consist of a Customs House, sheds, repairing shop, and a signalling station. The aerodrome will be particularly large.

The Conference at Geneva

The International Aeronautical Conference at Geneva concluded on Friday, and it was decided that the next meeting should take place at Madrid in October, 1921, and that an International Year-Book should be published containing digests of all documents and information likely to be useful to airmen regarding landing-places, aviation centres, signals, etc.

Germans Destroy Seaplanes

A report states that the workmen employed by the firm of Pintsch at Fürstenwalde, near Berlin, have destroyed 4 seaplanes and 28 torpedo throwers which were to have been delivered to the Allies.

The material destroyed was worth about 8,000,000 marks, and was to have been sent to Britain, France, Japan and America respectively. The workmen professed to have learned that it was destined for Poland. The garrison of Furstenwalde refused to intervene, saying that it was too weak.

The Air Conference, 1920

Owing to the rapidly increasing importance of aviation, the variety and complexity of the problems facing those interested in its development, and the desirability of an examination of the present situation and a mutual exchange of opinions on the subject, it is now officially announced that the Air Council has decided to call together an Air Conference. Its more immediate object will be to bring representative members of *all sections of the community* into contact with the practical work being done today with a view to assisting future progress.

In view of the nature of this Conference, the Lord Mayor has kindly granted the Air Ministry permission to hold it in the Council Chamber of the Guildhall, London, and has also consented to open the proceedings on the first day. It will take place on October 12, 13 and 14, 1920, attendance being by invitation.

The following have kindly consented to take the Chair on the three days respectively:

First Day—The Lord Montagu of Beaulieu.
Second Day—The Lord Weir of Eastwood.
Third Day—Admiral of the Fleet, Earl Beatty.

First Day.—The subject for consideration on the first day will be Civil Aviation. One paper will be read by Major-General Sir Frederick Sykes, G.B.E., K.C.B., C.M.G., Controller-General of Civil Aviation, on the present situation of Civil Air Services, British and foreign, the organization necessary for success and the prospects for the future. A second will be read by Mr. H. White-Smith, C.B.E., Chairman of the Society of British Aircraft Constructors, dealing with the demands of Civil Aerial Services from the constructional point of view.

Second Day.—The second day will be devoted to technical questions affecting both the civil and the service sides of the art. Papers will be read by Air-Vice-Marshal Sir E. L. Ellington, K.C.B., C.M.G., C.B.E., Director-General of Supply and Research, Air Ministry, on the development of aircraft. and by a representative of the Royal Aeronautical Society.

Third Day.—On the third day the broader aspects of service aviation will be dealt with at the morning session by Air-Marshal Sir H. M. Trenchard, Bart., K.C.B., D.S.O., Chief of the Air Staff, while the subject of airships. with special reference to their construction and commercial operation, will be taken up in the afternoon by Commander Sir Trevor Dawson, R.N.

After each paper has been read the subject dealt with will be open to discussion by those present. These discussions, it is hoped, will be of value in disseminating a fuller knowledge of the advantages and possibilities of transport by air, and will lead to the more general employment of aircraft in the future.

A Relay Race in Argentina

The relay race is steadily gaining in favor as an item in the program of aviation meetings.

At the Argentina Aeronautical Society's festival at Buenos Aires recently, an event of this nature was included, and it was won by a team composed of an Avro, a Curtiss and a Caudron.

Unveiling the Chavez Memorial

The ceremony of unveiling the Chavez Memorial at Brigue on September 12, took on quite an international aspect owing to the presence of the delegates, headed by Prince Roland Bonaparte, who had been taking part in the F. A. I. meeting at Geneva. From our photograph it will be seen that the monument is a very fine conception of the sculptor Colin, and it has been erected on the place St. Sébastien. Those who took part in the unveiling ceremony were each presented with a bronze medallion, bearing on one side a portrait of Geo. Chavez, and on the other a design symbolizing the flight across the Alps, together with the inscription: Brigue-Simplon-Domodossola, September 23, 1910. Among those present were a brother of Chavez, the Peruvian Ministers in Paris and Brussels, and a representative of the French Government. while flying overhead was an escadrille from the Dubendorf Aerodrome.

Franco-Turkish Air Mail

An Imperial *Irade* has been published ratifying the convention concluded between the Franco-Roumanian company and the Ottoman Government for the creation in June, 1921, of an aerial postal service between Paris and Constantinople.

Flying in the Congo .

The King Albert Aerial Line in the Belgian Congo has now drawn up a scale of charges. Correspondence will be surcharged 3 frs. per 20 grammes or fraction of 20 grammes. Passenger fares on mail machines will be at the rate of 12½ francs per kilometre, and luggage will have to pay 30 francs per kilometre per stage.

Paris-Strasbourg, etc., Service

A start was made on Monday with an aerial service between Paris and Strasbourg. At present the service from Paris will only be on Mondays, Thursdays and Saturdays, but if sufficient traffic is offered the service will later be made a daily one. Next week a service will be started between Strasbourg and Prague. and it is hoped to continue it to Warsaw at the middle of next month.

1000th Air Express

The 1,000th aeroplane to be cleared outwards by British Customs for foreign destinations this year left Croydom at 10:31 on September 17 for the Continent.

A New European Service

The formation of a new aerial transport company, under the title of the Air Post of Banks, Ltd., is announced. One of the functions of the company will be the carrying of valuable securities for the principal London and Continental banks, and arrangements are being made to provide what is described as an "ultra-rapid transport service for passengers and goods by air. steamship, motor and rail."

The machines adopted by the company are the Westland limousine aeroplanes, and a group of pilots under the direction of Mr. F. T. Courtney. The single passenger fare to Paris with 30 lbs. weight of luggage free, and inclusive of breakfast for early morning passengers, is £10 10s., and each single ticket entitles the holder to a return ticket for £8 8s.

London-Holland Route

A commission is leaving Holland for England this week, having been charged by the Minister of Public Works to inspect various wireless telephonic meteorological installations that have been established in the interests of airmen.

It is hoped that the work of the Commission will promote co-operation between British and Dutch organizations in the interest of existing and prospective air traffic between Holland and other countries by means of both land and sea planes.

German Air Mails

A regular air mail service was initiated between Berlin and Breslau during the Breslau Autumn Fair week, the distance between the two cities being covered in 2½ hours. The fair closed on September 11, but the service is likely to be maintained with a view to linkng up with the projected Paris-Strasburg-Prague and Warsaw air line. Another interesting development is contemplated in connection with the Berlin-Konigsberg air service, which it is ntended to extend to Reval and Helsingfors—possibly with an eye to Petrograd in the near future.

The German postal authorities are also in communication with the Swiss Government with a view to the early establishment of a daily air mail between Frankfort-on-the-Main and Bâle.

Air mails have been running daily in all weathers since July 21 last between Berlin, Bremen and Wangerooge, and no accident has occurred. The distance covered during the period represents 3,750 miles. The air mail starts at 6 a. m. daily from Johannisthal-Berlin and arrives in Bremen at 9 a. m. From Bremen to Wangerooge it takes about 50 minutes. On the return journey Bremen is reached at noon, and at 12:30 the aeroplane leaves for Berlin, arriving there at 3:30 p. m. The air fee for a letter is 20 pfg. over the ordinary postal rates, or about ¼d. at the present rate of exchange. The aeroplanes employed on the service carry five passengers in addition to mails and freight.

Twenty-Five Minutes Flight with Controls Locked

During the Air Ministry's trials at Martlesham, the big twin-engined tractor biplane "Centaur 2A" flew for 25 minutes with controls locked. The competition only called for a flight of five minutes uncontrolled, during which period the machine proved herself so absolutely stable that Mr. F. B. Goodwin Castleman, the pilot, decided to test her out. For 25 minutes he left the machine to fly itself with controls locked, during which time she flew straight and maintained her height.

London-Copenhagen Air Mails

Mails were sent by air from Copenhagen to London via Hamburg and Amsterdam for the first time on Wednesday, September 15. They left at 10 a. m., mails arriving from the other Scandinavian countries just prior to their departure. The departure was attended by many officials, and Prince Axel placed the first air mail bag on board the machine. Express letters will be delivered in the afternoon at Berlin and Hamburg, in the evening at Amsterdam, and on the following day in London at 1 or 2 p. m. The first aeroplane proceeds to Hamburg, where the mails are transhipped.

Aerial Regulations in France

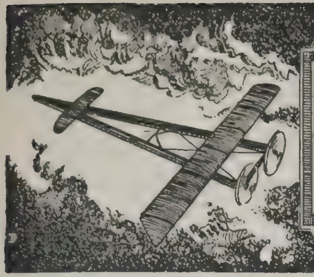
At last the French authorities have drawn up a series of regulations covering the inspection of aircraft, the issue of pilots' certificates and the control of aerial traffic in France, and they are to be embodied in a decree to be published shortly. They are almost identical with the British regulations in accordance with the International Convention.

New Italian Dirigible on Trial

On September 16 the new Italian dirigible "Roma" made a trial trip over Rome, but no details are available as to the results attained.

The airship is of the semi-rigid type, with a capacity of 34,000 cubic metres; it has three pairs of 400 h.p. motors, and can travel at from 68 to 74 miles an hour, but one pair of engines will keep up a speed of 56 m.p.h.

There is some talk of the airship being bought in the U. S., in which case she will make the journey by air. It was originally intended that she should go to South America.



ELEMENTARY AERONAUTICS
and
MODEL NOTES

By John F. McMahon

CLUBS

PACIFIC NORTHWEST MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIVERSITY AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.
TRIANGLE MODEL AERO CLUB
Baltimore, Md.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
BUFFALO AERO SCIENCE CLUB
c/o Christian Weyand, 48 Dodge St., Buffalo, N. Y.
THE ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.
CAPITOL MODEL AERO CLUB
1726 M Street, N. W.
Washington, D. C.
AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St.,
N. Y. City
AERO CLUB OF LANE TECHNICAL HIGH SCHOOL
Sedgwick & Division Streets, Chicago, Ill.

The Curtiss Model

The struts are made of spruce ¼" x ⅛" and made to a streamline shape, the bottoms being rounded to ⅛" to fit into the ⅛" strut socket which can be purchased at a model supply house. The lengths and spacing of the struts can be had from the front view at the bottom of the drawing. It will be noticed that the wings have a slight dihedral angle. The angle is shown by the broken line under the right bottom wing.

A sketch of the rigging of an aeroplane is shown at the right.

The fuselage of the model made also to be covered with silk.

The construction of the Tail, Rudder and Fin needs no explanation other than the dimensions in the accompanying drawing. One thing must be remembered, that is, to make these members as light as possible without sacrificing strength.

The model builder must remember that every ounce of weight on the tail means about eight ounces at the nose in order to bring the center of gravity where it should be, at a point over the thumb and indicated by the arrow in the side-view sketch shown at the bottom of the drawing.

These parts are covered with silk and placed in position as shown in the sketch of tail and rudder assembly. The tail should be fastened rigidly but the rudder should be so fastened as to allow free movement to set rudder in order to correct the turning of the model caused by the twist of the propeller, or when attempting to do stunts in the air.

When assembled the model should be doped with the celluloid solution described in an earlier issue. (Numerous inquiries have been received as to the amount of celluloid and banana oil used in this combination. A piece of thin transparent celluloid, 4" x 4", dissolved in a pint of pure banana oil will give the best results. If the banana oil is not pure it will turn white when dry).

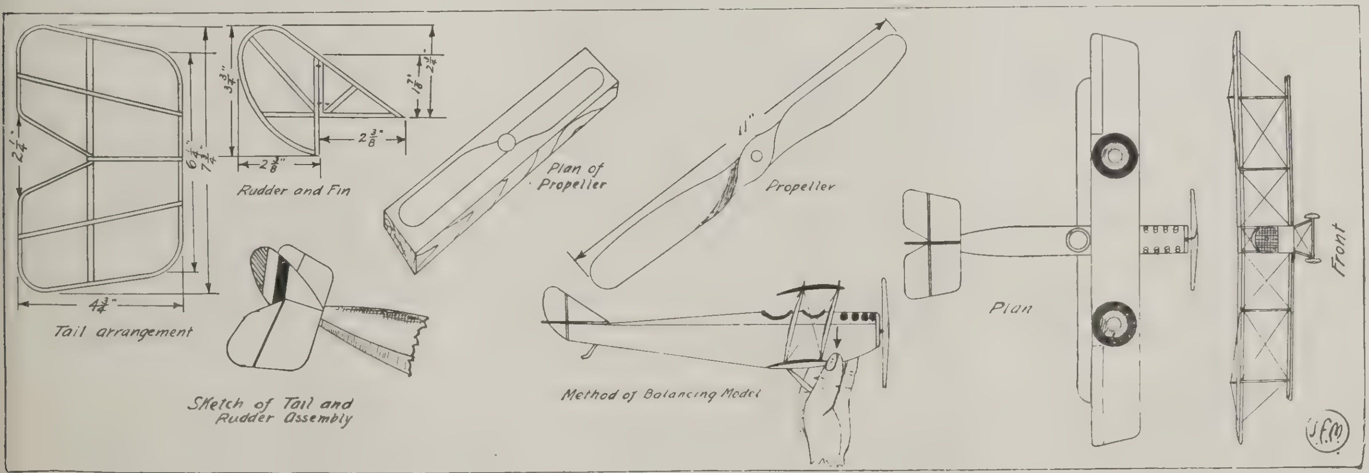
The propeller is cut from a block of soft white wood ¾" thick to the shape shown in the sketch. It is made fairly heavy in order to hold the nose of the machine down and to assist in properly locating the center of gravity. In fact the propeller can be made to weigh as much as two to three ounces, and even with this weight it might be necessary to put an extra ballast in the nose of the machine because the center of gravity must come at the point shown in the sketch. The model can be balanced easily by holding as shown in the sketch. If the tail is heavy it will be necessary to put an additional weight at the nose of the machine. Should the nose be heavy, you need not worry, because a little nose heaviness does not harm the flying qualities much, and this can be corrected by giving a slightly greater angle of incidence to the main planes; or a little lesser or negative to the tail plane.

When attempting to fly the model I would advise selecting a field where the grass or weeds are long because the model may be a little "out of balance" and make a sharp nose dive or "sit on its tail" and the long grass will act as a cushion.

The model builder should have little trouble laying out and assembling the models, the Plan, Front and Side views should give all the information necessary.

If the instructions I have given are strictly carried out, the model builder will have little trouble in making the model fly 250 to 500 feet. (I might call attention to the measurements of the fuselage. Through an error, I forgot to state that the dimensions given alongside of each strut in the side view and at the bottom of the top view, shows the length of the struts and not width of the body. For instance, the greatest dimension given was 1⅞", adding the thickness of two ⅛" longerons will make the body 2⅛", which is correct.)

To finish the model paint red, and blue stripes on the rudder as indicated in the drawing. Red at the rudder post and equal space of white and blue outside. The circles on the wings are, outside red, next blue and the inside circle left, white.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Chatty Colonel

"Yep," said the second loot proudly, "the colonel and I are just like that with each other. Whenever he sees me he has something to say to me."

"That so?" inquired the first loot admiringly. "What does he say?"

Gold bar puffed out his chest. "Oh, he always says, 'Lieutenant, how long have you been in the Army, anyway?' "—*American Legion.*

An Aerial Dream

Sergt. R. Zaleski and B. Walters, March Field, trans-Pacific flyers, are still undecided as to what type plane they will fly this fall in their attempt to cross the Pacific ocean. They are reported favoring the Mystery Ship, if it is possible to convert it into a flying boat. Both men are not keen for mid-ocean swimming.

Men of the Command extend their good wishes and sympathy. Watch for the take-off on September 31. They should reach China on the 32nd.

The flight will be made in three legs; from Long Beach, Cal., to the Semetria Islands, 2,489 miles; from Semetria Islands to the Philippines, 1,741 miles; from the Philippines to Singaport, 1,238 miles, and thence to China. They will keep in radio communication with March Field at all times.

Should this attempt fail, Zaleski reports they will climb to an altitude of 20,000 feet and wait for the world to make one complete revolution, then nose her down and cop the $50,000 award offered by Thomas Ince.

Baseball in the Air

By Jack Sayles

A game of clout the ball,
By flying men, that's all!
A test for skill and brains—
Home runs in aeroplanes.

"What? Baseball in the air?"
You say "They wouldn't dare!"
Come off. They hopped the deep.
Without a wink of sleep
They carry aerial mails
Through winter's sleety gales;
They jump from plane to plane
While traveling amain.
If tricks like these get by
Then—baseball in the sky!

Locklear could do a slide
Like Tyrus Cobb, or glide
Around the sacks in truth,
Like Home-Run Babe Ruth.

Commander Reed could dive,
Down base lines damp—and thrive.
He crossed the ocean blue,
And splashed a time or two.

Sir Captain Brown has speed,
To steal a base like Reed,
He'll show the fans the zip
That marked his ocean trip.

They'll use the clouds for bases,
Among the upper spaces;
And side-line routes display
Along the Milky Way.

The man that's in the moon
Will be a rooter soon,
And so will all the stars
From Jupiter to Mars.
The shouting angel clans
Will all be bleacher fans.

Some day you'll feel the earth,
To shake with cosmic mirth.
You'll know without our telling,
The planets all are yelling,
'Twill be a game for fair,
A whole-souled, grand old
Ball game in the air!—*Top Notch.*

Trailmen of the Air

Over the pines, where we used to go under,
And the world all white below,
With the eagle watching our flight in wonder,
On the lawbreaker's trail we go,
Thief of a Cree, with a sledful of takings,
Frenchy, who murdered a pard;
They and their kind are our combings and rakings
Since the aeroplane crew stands guard.

Over the plains, where we plodded long hours
To the squeak of the snowshoe thongs,
Now we look down, as from sky-piercing towers,
While the motor is droning its songs.
Weary the miles that we made in the saddle,
Short are those miles to-day;
And yet for the pony, the sled, and the paddle
We long as we wing our way.

—*N. Y. Sun.*

Letters from Privut Pete

Dere Mister Editer:—Bein' married and enlisted in the Air Service at the same time is like tryin' to get off a crowded street car in a rush. You just can't help stepping on somebudys toes. At least that seems to be my luck cause never nothing goes wrong with me out here at the field but what it has to go an follow me home. For instance right after I've made a name for myself as a Privut some energetic young captain comes along and recommends I be made a corporal, not knowing how disappointed I would be.

And along with that disappointment I goes home only to find Flo in tears because she'd spoiled the dinner by putting hydro puro in the pot roast thinking it was salt. But I fixed that up pretty nice by calling up some friends of ours inviting us over to their house for the evening. I knew what time Jack got home to eat so we timed ourselves to reach their house just as they were sitting down to the table.

I was best man at Jack's weddin' and loaned him the bank note with which to pay off the parson so he couldn't very well refuse from askin' us to have something to eat. Flo and I started in with the desert first so as to make 'em believe we already had our dinner at home and finished up with some Rockfort cheese and a demitasse cup of tea. If it had a come to a rough an tumble I'd a backed the cheese, the tea was all in.

An after the evening meal we all went into the front parlor and started playing "solo." That's a new card game and of course I had to play the part of a cadet for the first hour or so. But Flo and I finished strong and reached home safely with most of Jack's ready cash and an i. o. u. for a pound of raisins. I put in an order last week for a cake of yeast and the grocer said he'd give it to me tomorrow, so that when Jack comes over to our house next week I'll be in fine shape to trim him again.

Yours with a hitch in it— "Pete," *in The Flyleaf.*

UNIVERSITY OF ILLINOIS LI

AERIAL AGE
WEEKLY

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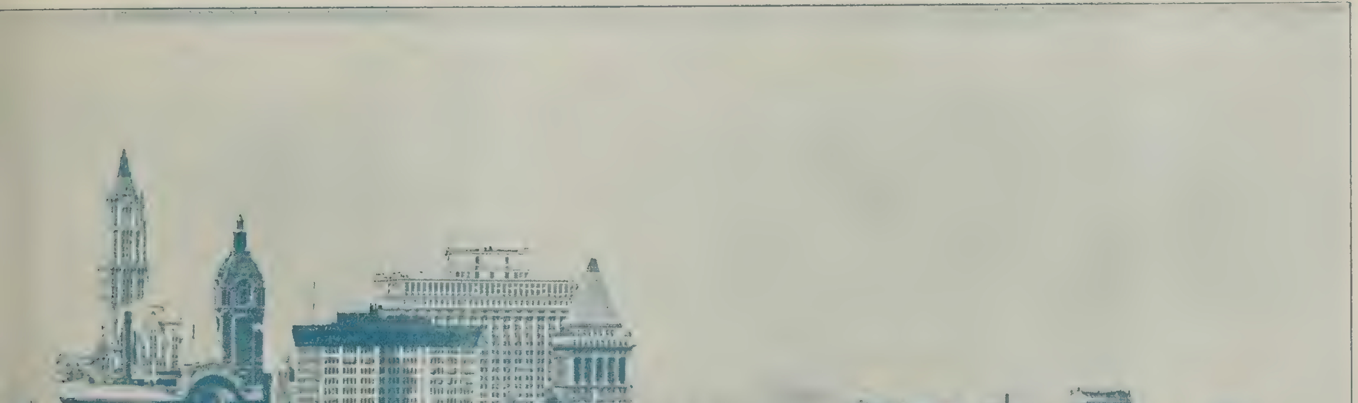

Official Photograph U. S. Army Air Service

A Remarkable Airscape of Downtown New York

An Important Announcement to the Aeronautic Industry

HED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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The RUGGLES ORIENTATOR

is now installed at the

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Atlantic City

Every useful facility, premier instructors, splendid ships and an ideal living and working environment render the **Curtiss Flying Station,** Atlantic City, the school par excellence for those students who desire to fly with superlative skill. Facilities and equipment especially desirable for the comfort and convenience of ladies is provided. Telegraph for your reservation.

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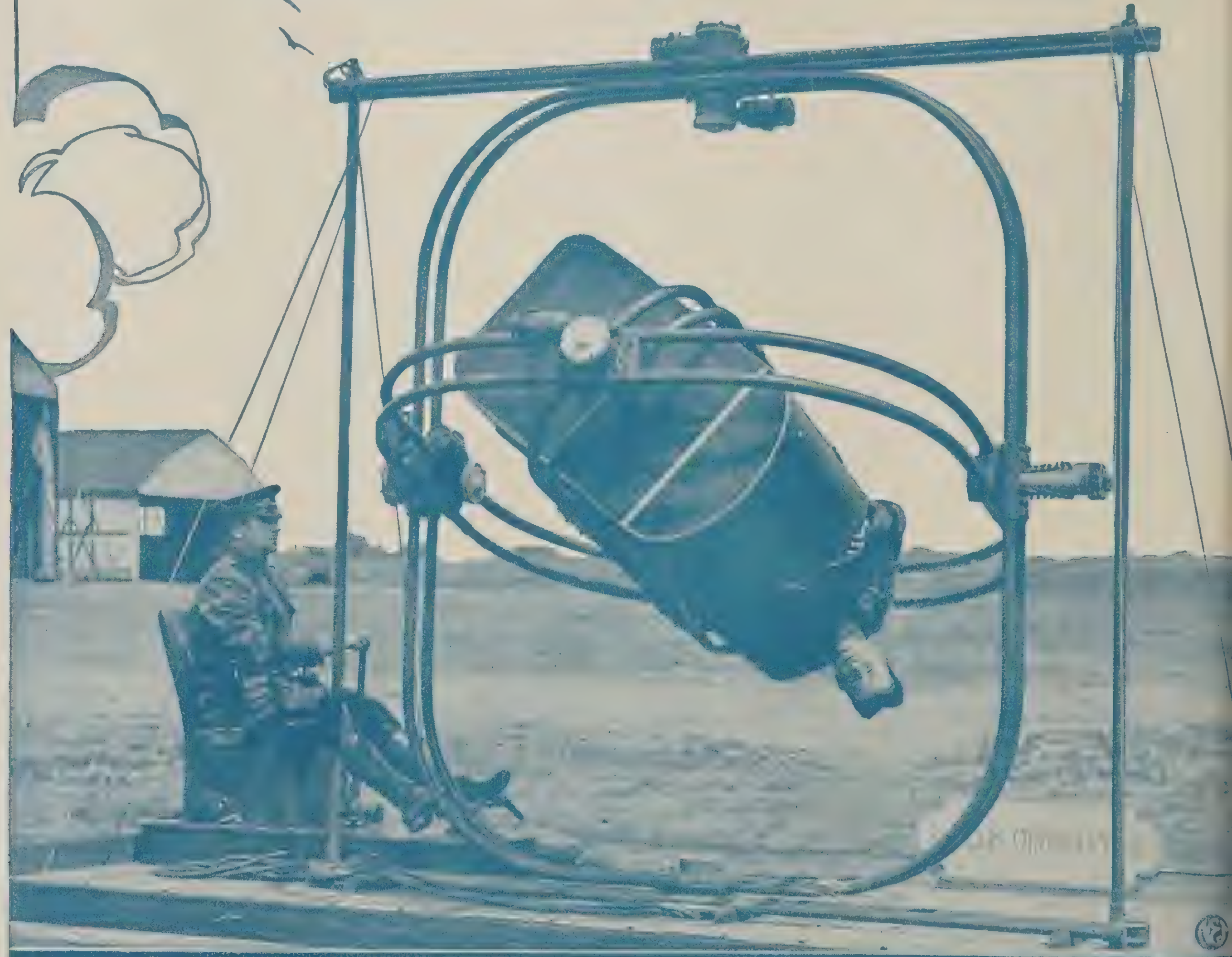

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WEEKLY

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An Open Letter to the Aeronautic Industry

By G. DOUGLAS WARDROP

WITH this issue of AERIAL AGE WEEKLY, of which the writer has been Managing Editor since 1915, the paper enters a new regime.

I have secured and own one hundred per cent of the stock of the Company, and from now on will administer the affairs of the company as its President and Treasurer and Editor, with a view only to serving the best interests of the aeronautic industry.

It will now be my policy to devote the editorial pages to constructive discussion of matters of importance to the Industry.

Inter-relations of aeronautic organizations may be referred to in the news pages, as their relative importance merits, but the purpose of the editorial pages will be to interpret the best group-opinion on the burning issues before the aeronautic fraternity.

The aeronautic press in the past has apparently failed to properly present the views of the American business men who have millions invested in the aeronautic industry, and it will be our privilege to secure these opinions and present them to our readers with whatever comment they may seem to merit.

AERIAL AGE WEEKLY is the logical paper to undertake this constructive work, for it has by far the largest body of readers, as is clearly indicated by the latest reports of the Audit Bureau of Circulations, which shows that its total distribution is 9,892 copies.

Mr. Henry Woodhouse, who has been the dominant factor editorially in AERIAL AGE during the last five years, ceases absolutely to have any connection, directly or indirectly, with AERIAL AGE nor will he hold any of the stock.

The time has arrived when everyone interested in "selling" aeronautics to the American people should get together and work constructively towards this end, and it will be the purpose of AERIAL AGE to make "aeronautic public opinion" as homogeneous as it is possible to make it.

THE NEWS OF THE WEEK

Aero Club Head Back From Aviation Race

Col. Jefferson De Mont Thompson, president of the Aero Club of America, who attended the race for the Gordon Bennett Cup in France, returned to New York recently regretting that the American planes were unable to show their real worth in the Gordon Bennett race because of accidents, after one of them in trial had attained a speed of 185 miles. Col. Thompson looked into aerial police conditions abroad and will report the result of his investigations to Mayor Hylan and Police Commissioner Enright. Brussels, the Colonel said, is about to install an air police force and Paris and London had made appropriations for the same purpose.

Carries His Air Mail at 163 Miles An Hour

Salt Lake City.—All previous records over the air mail course between Salt Lake and Rock Springs, Wyo., were broken October 15 when Pilot Yeager with ship No. 100 made the 163 miles in one hour and ten minutes, clipping fifty minutes off the previous record.

Hounds Travel by Air

Chattanooga, Tenn.—On receipt of a telegraphic message that a building of the coal mining company at Pruden, Tenn., had been destroyed by incendiaries, bloodhounds belonging to Perry Phipps of this city, were dispatched there by aeroplane from Marr Field, probably being the first time on record that manhunting dogs have been transported in this fashion to trail down criminals.

Battleship Used as Bomb Target

Norfolk, Va.—Bombed from the air by five navy planes, the decks of the battleship Indiana are strewn with wreckage, twisted steel and bits of shells, but the former old pride of the American navy is still afloat in Lynnhaven Bay.

Five planes of the F-5-L type were sent out to attack the ship. Twenty-five bombs in all were dropped but some of them did not hit the ship.

Five of the bombs, according to reports received here, hit the target squarely and tore up a part of the deck of the ship. Her stacks were also struck.

The Indiana was under way during the firing at about ten miles an hour. There was not a soul on board, but she was under perfect wireless control while the experiments were going on. She appeared like a "spirit" ship. Her movements were directed from the radio room of the battleship Ohio which steamed along with her, but about five miles away.

The planes went after the ship in battle formation. Then the separated and in single file attacked their helpless prey from all points. The skillful radio operator of the Ohio would send the Indiana first in one direction and then another, but every way she went there was a plane overhead.

American Crew Take Dirigible Over London

London.—Much mystery surrounded the appearance over London of the great dirigible R-32 during the celebration attending the arrival in London of the Prince of Wales. Its presence was not a part of the official program. The Manchester *Guardian* explains the matter thus:

"The R-32 is being used as a training ship for the American crew which will take the dirigible R-38 across the Atlantic to America. The Americans were determined to see the Prince, and in order to take no chances they journeyed in the airship all the way from Howden, in Yorkshire.

"Incidentally, the R-32 was one of the features of the celebration, as she was a magnificent spectacle with her silver sides glistening in the sunshine."

Army Flyers Reach Saskatoon

Washington.—Capt. St. Clair Street of the Air Service Alaska Flying Expedition reported his arrival October 10 at Saskatoon, Saskatchewan. Capt. Street was expected at Portal, N. D., Oct. 12. Lieut. Kirkpatrick was last heard from at Portal.

The scheduled stops east of Fargo are Winona, Minn., Grand Rapids, Mich., and Erie, Pa. The Alaska flyers are expected to reach Mitchel Field, Mineola, this week.

The Liberty motors are reported to be in excellent condition.

Carry the Gospel by Air in Oregon

I rode over Portland, Ore., in a propaganda aeroplane. It belonged to a new old religious cult, the Apostolic Faith, which is gaining both members and money —and is exerting the last to gain the first.

It has printing presses, motor cars, motor trucks and the aeroplane in which I rode. This last is called the Sky Pilot, and has the cross and the crown painted on the under surfaces of its planes, writes Edward Hungerford in *Harper's* for October. Literally it carries the gospel to

Aerial photography has vast commercial possibilities and they are now being widely investigated and applied the far corners of Oregon; the dominie is a war graduate aviator and speaks with the force which comes from real experience.

It is a long cry—and a long nineteen hundred years—from Christ and His disciples toiling across the sands of Judea to the dominie of the Apostolic Faith hitting up his Curtiss at ninety miles an hour. Yet I do think that old Saul of Tarsus would have loved a De Haviland four, and that even the gentle John would have seen a certain spiritual aspect in a twelve-cylindered motor car.

Rohlfs' Comment on Gordon Bennett Race

Roland Rohlfs, one of the American fliers in the Gordon Bennett races held in France, returned from France recently. He was slightly injured when the Curtiss-Cox entry, the Texas Wildcat, which he was flying from the test field at Villa Coublay to the starting field at Etampes, on the day before the race, struck rough ground and turned turtle. Rohlfs sustained a broken shoulder but expects to be flying again within a short time.

He had nothing but praise for the French and declares that the only possible cause for complaint was the failure of the French Aero Club to acquaint the American entrants of the true condition of the Etampes field.

"The Etampes field was, perhaps, the best that was available," said Rohlfs. The trouble was that we were led to believe that France abounded with perfect flying fields and therefore designed our machines to operate under perfect conditions. The fields were not perfect. In fact, they were not as good as some of our own Long Island fields.

"There is absolutely no foundation for belief that the French selected a field which would be advantageous to their entries.

"France was not ready for such a race and there was little interest in it. I don't believe they had any idea that the American machines would develop the speed they did and as a result no advance efforts were made to level the fields to accommodate that speed.

"The main difficulty was that we did not have sufficient time after we arrived in France to adjust our machines to the conditions we found there. When we found what the conditions were we tried to meet them but the time was too short. The French gave us every possible assistance and the French fliers were extremely friendly.

"The French fliers, too, knew the course like a book. They made no special effort so far as real speed was concerned. Sadi Lacointe, the winner, flew his machine constantly before the race without any fear of damaging it. During the race he flew at an alarmingly low altitude—at times his wheels were only two feet off the ground. Lacointe, by the way, is a wonderful pilot and his victory was both popular and deserving.

"We would naturally have liked to see the American entries win and the American entries were by all odds the fastest. In my flight over to the Etampes, I flew throttled and got 150 miles per hour out of my machine and I had at least 40 miles per hour in reserve.

"Schroeder and Rinehart, the other American pilots, had ill luck. Schroeder never got his motor started until four minutes before the end of his thirty-minute time allotment. He took off but only went the length of the field. Rinehart got up and travelled a short distance but soon returned."

United States-Canada Aerial Navigation

The following is correspondence between the State Department and the National Advisory Committee for Aeronautics in regard to the application of Canadian regulations for air navigation to American aviators:

NATIONAL ADVISORY
COMMITTEE FOR AERONAUTICS

July 30, 1920.

The Honorable,
The Secretary of State,
Washington, D. C.

Sir:

Your letter of June 17, 1920 (No. Ta-842, 796/25), relating to certain regulations of the Canadian Air Board affecting pilots and aircraft of United States nationality, was considered at the regular meeting of the Executive Committee of the National Advisory Committee for Aeronautics, held on July 29, 1920.

In reply to your letter, I have the honor to quote the following resolutions from the minutes of said meeting:

"Resolved, That the National Advisory Committee for Aeronautics recommends to the State Department that the Government of the United States express its appreciation of the courtesy of the Canadian Air Board in permitting United States pilots and aircraft to fly in Canada until November 1, 1920, under the same conditions as would obtain if the Government of the United States had passed regulations similar to those of the Dominion of Canada;

"Resolved Further, That, in view of the fact that the Congress of the United States is not at present in session, and will not meet until December, 1920, the National Advisory Committee for Aeronautics recommends that the Government of the United States request the Canadian Government to extend, by six months from November 1, 1920, the period during which United States pilots and aircraft will be permitted to fly in Canada under existing conditions."

Respectfully,
National Advisory Committee
for Aeronautics,
(Signed) Joseph S. Ames,
Chairman Executive Committee.

DEPARTMENT OF STATE
Washington

September 2, 1920.

National Advisory Committee for
Aeronautics,
2722 Navy Bldg., 17th & B Sts., N. W.,
Washington, D. C.

Gentlemen:

The receipt is acknowledged of your letter of July 30, 1920 (your file 15-36-3565) relating to the temporary regulations of the Canadian Air Board, the effect of which was that qualified pilots and aircraft of the United States would be allowed to fly in Canada until November 1, 1920, on the same basis as if the United States Government had established air regulations as contemplated under the International Convention relating to air navigation.

You are advised that the Consul General of the United States at Ottawa has been instructed to approach the proper officials of the Canadian Government and express the appreciation of this Government for the courtesy extended to pilots and aircraft of the United States. He has also been instructed to advise those officials that, at the recent session of the United States Congress, a bill was introduced to provide for the regulation of internal and international air navigation, but that there was no further action on the bill.

You are also advised that the Consul General has been instructed to inquire whether the Canadian Government would be willing to extend, by six months, the period during which United States pilots and aircraft will be permitted to fly in Canada under existing conditions, in order that time may be given for the United States Congress to pass appropriate legislation providing for the regulation of aerial navigation.

I am, Gentlemen,

Your obedient servant,
For the Secretary of State:
(Signed) Norman H. Davis,
Under Secretary.

Completes First Air Flight Across Canada

Vancouver.—Flying the last sixty miles in thirty-five minutes, Commander Tylee and Captain A. G. Thompson, pilot, landed here October 17th, completing the trans-Canada aeroplane flight from Halifax.

Colonel Robert S. Leckie and Major Basil Hobbs, in command on the first leg, crashed a short time later near St. John, N. B., but were not injured. The flight, resumed after a relief plane was taken to Colonel Leckie, was delayed in several instances by weather.

Mr. Benjamin Hillman, Major Charles J. Glidden and Commodore Beaumont who made a trip around the world to organize the Round-the-World Aerial Derby. The Commodore was tendered a reception at the Aero Club on his arrival recently from France

The AIRCRAFT TRADE REVIEW

German Air Plans in U. S. Alarm British Experts

London.—Sir Trevor Dawson, Vice Chairman of the Vickers Company, which is largely interested in constructing aeroplanes and airships, thrilled the final session of the Air Conference at the Guildhall on October 15. Sir Trevor told the assembly that the Zeppelin Company is negotiating with American interests for the organization of an air service operated from a base in Spain to the United States and South America. The Zeppelin Company is now engaged on plans for airships of 3,500,000 cubic feet, capable of a speed of 100 miles an hour and of carrying thirty tons of passengers, freight and mails from San Francisco to Berlin.

So, Sir Trevor warned, at the outbreak of the "next war" Germany would have air liners actually in operation which would at once deal death and destruction to England.

The discussion at the session turned chiefly on Great Britain's preparedness in the air for another war. A resolution, unanimously adopted, called upon the Government, before granting any reform to Egypt to take measures to secure a permanent air base at Cairo The militarist tone of the whole proceedings was most significant.

C. M. Keys Discusses Aircraft Tariff

That a tariff to prevent the dumping of old aeroplane material from Europe left over from the war into the United States is necessary to insure the proper growth of aeronautical manufacturing in this country is the view of C. M. Keys, who recently purchased the controlling interests in the Curtiss Aeroplane and Motor Corporation.

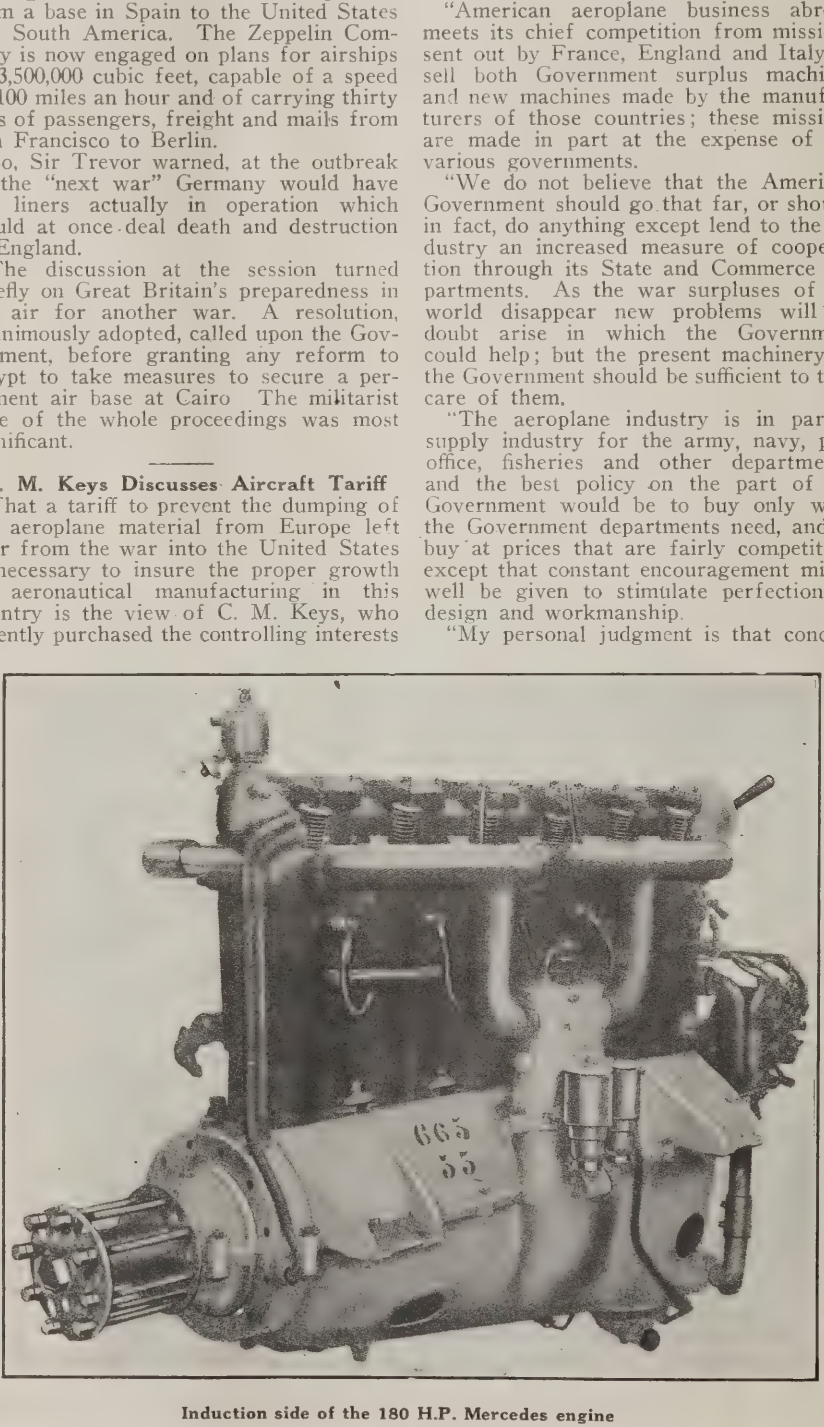
"I do not believe that in the aeronautical field any protective tariff is required so far as new material is concerned," said Mr. Keys, "but the tariff to prohibit the dumping of war surplus aeronautical material in this country is essential, the lack of it being one of the main causes of the present unsatisfactory conditions in this business.

"American aeroplane business abroad meets its chief competition from missions sent out by France, England and Italy to sell both Government surplus machines and new machines made by the manufacturers of those countries; these missions are made in part at the expense of the various governments.

"We do not believe that the American Government should go that far, or should, in fact, do anything except lend to the industry an increased measure of cooperation through its State and Commerce departments. As the war surpluses of the world disappear new problems will no doubt arise in which the Government could help; but the present machinery of the Government should be sufficient to take care of them.

"The aeroplane industry is in part a supply industry for the army, navy, post office, fisheries and other departments, and the best policy on the part of the Government would be to buy only what the Government departments need, and to buy at prices that are fairly competitive, except that constant encouragement might well be given to stimulate perfection of design and workmanship.

"My personal judgment is that concentration of the activities of all of the Government departments in essentially air service would probably greatly increase the efficiency of the Government and stimulate the industry; but on this subject there are many contrary opinions entitled to respect."



Induction side of the 180 H.P. Mercedes engine

Los Angeles Has Aircraft Examining Board

The following men compose the new Aircraft Examining Board of Los Angeles County: K. M. Turner, President of the Aero Club of Southern California, Los Angeles; G. Edw. Barnhart, Pasadena, designer and builder of airplanes; Leon T. Eliel, Pasadena, president of the Sierra Aircraft Company; George Hockensmith, Los Angeles, head of the aeronautical department of the Goodyear Tire & Rubber Company; Emery H. Rogers, Venice, president of the Pacific Airplane & Supply Company; David B. Thompson, Hollywood, field manager of the Mercury Aviation Company; Hal R. Wells, Los Angeles, field manager of the Chaplin Aircraft Corporation.

The names were submitted to the County Board of Supervisors on Sept. 29 by County Counsel A. J. Hill. The Board will have a meeting early in October to select a County Inspector of Aircraft and formulate plans for enforcement of the county ordinance regulating flying and licensing flyers.

Trade Mark Law Modified

An amendment to the Federal Trade Mark Act renders it now possible to register many marks not heretofore registrable.

One reason for this amendment was to enable American owners of such heretofore non-registrable marks to secure Federal registrations particularly for use in foreign countries because of the frequently recurring cases of foreign piracy of American trade marks. In many instances foreigners have registered American trade marks with consequent damage to Americans when American goods bearing the trade mark arrive in such foreign countries.

Mid-Air Changes of Postal Plane Pilots Planned

Chicago.—The reckless aerial acrobatics with which Omer Locklear startled the world until they resulted in his death recently in California have not been in vain, according to air mail service officials here, for they report Locklear's "stunts" have opened the way for important developments in commercial aviation.

Locklear's stunt of changing from one plane to another several thousand feet above the earth will be copied in the air mail service and by commercial aviation companies in changing sacks of mail, packages or pilots from one ship to another, thus enabling aerial liners to make long journeys without landing, officials say. Some believe that within a short time aeroplanes may even take gasoline and supplies in the air.

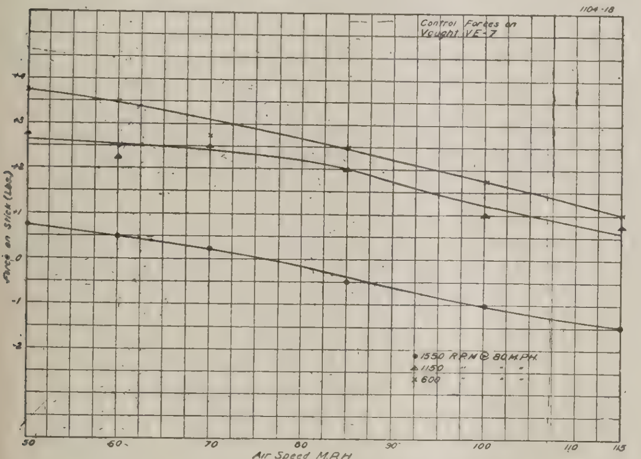
NOTES ON LONGITUDINAL STABILITY AND BALANCE

By Edward P. Warner

MORE or lsss complete studies of longitudinal stability have now been made on five aeroplanes,—the JN4H, DH4, VE7, USAC-11 and Martin Transport. In addition to these tests, numerous modifications have been made in the design of the JN4H and the effect on stability and balance investigated.

The tests on the DH4 and on the JN4H as normally used are described and discussed in Report No. 70 of the National Advisory Committee for Aeronautics, and the methods of making the tests and interpreting the results are also taken up in some detail in that report. The conclusions drawn may, however, be summarized here.

The balance of an aeroplane, and its degree of nose-heaviness or tail-heaviness at any speed and throttle ,setting can manifestly be determined by measuring the force which the pilot must apply at the upper end of the stick in steady flight. This force can always be modified in either direction and in any desired degree by changing the stabilizer setting, and this means of correction should be chosen in preference to moving the C. G. relative to the wings unless there is special reason for adopting the latter plan. The balance, as expressed by the force required on the stick, is much affected by the weight and chord of the elevators. The JN4H, for example, is very nose-heavy when normally rigged, but this is not because the C. G. is too far forward (it is, on the contrary, too far back) but because the static moment of the elevators about the hinges, due to their own weight, is abnormally large, and a large pull (about 8½ lbs.) on the stick is required to hold the flippers up, even when there is no downward air load on them. Machines with adjustable stabilizers can, of course, be made to balance at any speed by adjustment of the surface.

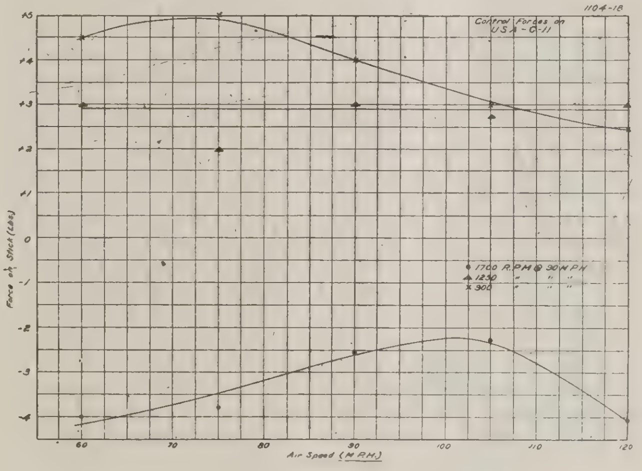


The stability with free controls can best be determined by measuring the force on the stick at a fixed throttle setting and a number of different air-speeds and plotting the forces as ordinates (a pull on the stick being taken as positive) against the air-speeds as abscissae. The necessary and sufficient condition for stability with free controls at any speed is then that the curve of forces shall have a negative slope at that speed, and the steeper the negative slope the greater the stability. The machine cannot, of course, be flown with free controls at any speed except the one at which the curve crosses the horizontal axis, but this axis can easily be shifted vertically if desired by attaching a counterweight, spring, or elastic to the stick in such a way as to change the "effective weight" of the elevators, and so the pull on the stick due to that weight. The actual measurement of the forces at several different speeds and the plotting of a curve is far more accurate and satisfactory as a means of determining longitudinal stability than is the customary method of recording the pilot's impressions on the subject, as it practically eliminates the personal equation, and gives a definite quantitative result in place of such vague phrases as: "Stability very good"; "Stability poor"; "Stick pushes strongly against the hand at low speed".

Discussion of Experiments

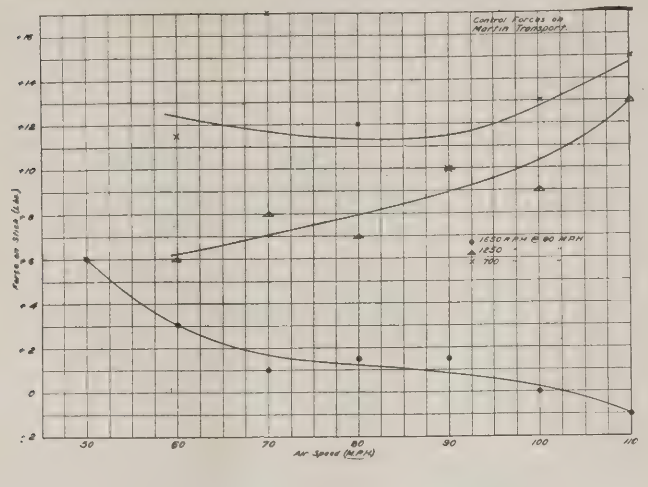
The force curves for the five machines which have so far been studied, with data taken at three or four different throttle settings for each machine, are plotted in Figs. 1 to 5. The stabilizer on the DH4 was set with its center line parallel to the chord of the wings. There was no means of determining the stabilized setting on the Martin Transport while in flight, but it was adjusted to trim at 100 m.ph. with the throttles open, and this setting was maintained throughout the tests.

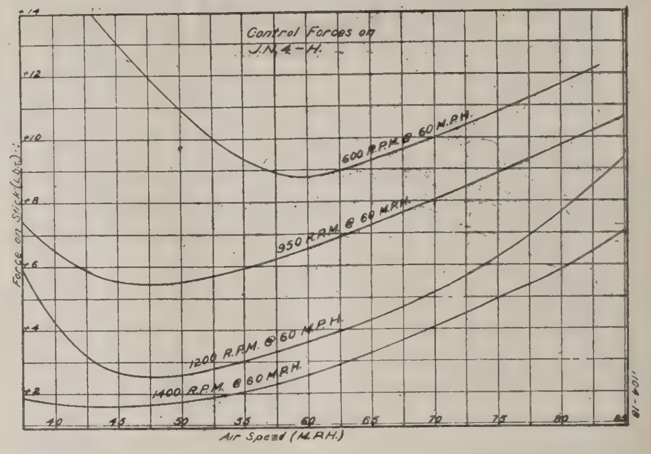
There is no very consistent rule for the variation of stability either with throttle setting or with air-speed, although the general tendency is to be more stable when gliding than with open throttle. The Martin and Curtiss are more stable at low air-speeds than at high, while just the reverse is the case with the DH4 and LePere. The Vought is extraordinary in that it possesses the same degree of stability, and just about the ideal degree, at all engine speeds and all air-speeds. It will be noted that the JN stabilizer is flat on the lower surface, that of the Vought slightly convex, while those of the DH4 and LePere are nearly symmetrical. It appears then, that all of these machines except the Martin follow the rule that a convex camber of the lower surface of the stabilizer is favorable to stability at high speeds, and that, in order to secure the same degree of stability under all conditions of flight and to keep the force on the stick comfortably small at all times, the camber of the lower surface should be from one-quarter to one-half that of the upper. The fact that the Martin forms an apparent exception to this rule should not be regarded too seriously, as the friction in the controls on that machine was so great that the force readings cannot be depended on to be accurate within two or three pounds. Further tests on the JN have shown that the stability at high speeds is much improved when the stabilizer or tail-plane is inverted.



The degree of stability in an aeroplane with an adjustable stabilizer or tail-plane depends largely on the setting of that member and such a machine will, from this cause alone, be more stable when gliding than with throttle open. The curves for the Martin for example, would be much more stable (larger negative slope) if the stabilizer or tail-plane had been set to trim at 100 m.p.h. while gliding, rather than while operating at full power.

If there is instability in an unpleasantly large degree, it may be corrected by: (a) moving the center of gravity farther forward; (b) setting the stabilizer or tail-plane at a larger negative angle to the wings; or, (c) using a larger stabilizer or tail-plane. These conclusions are not only the result of theory, but they have also been checked by actual tests on the JN4H, in the course of which tests the stagger was decreased (this being equivalent to a forward movement of the center of gravity relative to the wings), the C. G. was moved both horizontally and vertically by the attachment of weights at various points, and the stabilizer or tail-plane angle was



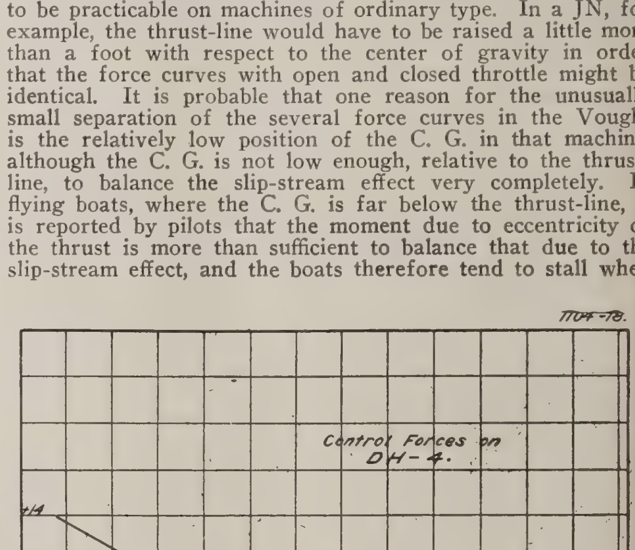


altered several times. In order that the machine may not be made excessively nose-heavy or tail-heavy it is usually necessary to combine (a) with either (b) or (c). The effect of increasing the size of the stabilizer or tail-plane can be secured by any means which steepens the lift curve of that surface and so increases its stabilizing efficiency. In particular, this object may be accomplished by increasing the aspect ratio of the stabilizer or tail-plane or by using a more efficient section or a section more efficiently presented. For example, there is, under all ordinary conditions of flight, a downward load on the stabilizer or tail-plane, and a section flat on the lower surface, like that employed on the JN, is therefore working at a negative angle of attack, a condition in which the lift curve has a materially smaller slope than it has for positive angles. It might, therefore, be expected that the stabilizing effect of the tail-planes of the JN would be improved by inverting the section, making the upper surface flat and the lower one cambered, and this has been found to be the case. It has already been shown, however, that the section of the tail should usually be controlled by the consideration of securing the same degree of stability at all speeds.

If the elevator were weightless, or if its weight were balanced, and if there were no moment about the elevator hinge when there is no force on the elevator, stability with free controls at the trimming speed (the speed at which the machine would fly if no restraint of any sort were placed upon the stick) could be satisfactorily investigated in the wind tunnel by removing the elevators from the model and testing it for longitudinal stability with only the stabilizer or tail-plane in position, and a test of this sort furnishes a fairly satisfactory approximation to the truth under the conditions actually existing. Unfortunately, however, neither of the conditions stated above are, in general, observed, and the problem of analysis of the tail forces, their distribution between the fixed and movable portions and their effect on stability becomes one of great complexity, usually soluble only by direct experiment on full-sized machines in free flight.

For a section, symmetrical about its center line, the angle of attack at which the pitching moment about the leading edge is zero is of course identical with the angle of zero lift. For unsymmetrical sections, such as are very commonly used in stabilizers and elevators, the moment about the leading edge disappears when there is a considerable negative lift, and, conversely there is a moment tending to raise the trailing edge of the elevator when the net lift of that member is zero. It is then evident, if the assumption of a weightless elevator be abandoned and if the interference between stabilizer and elevator be neglected for the moment, that, with the controls free, there will have to be a larger upward force on the elevator, in order to balance the moment about its hinge due to its own weight, if the surface is flat above and cambered below than if the more usual reverse disposition is adopted. Since any upward force on the elevator requires a counter-balancing addition to the downward force on the stabilizer, this is a point, although not a very important one, in favor of the tail-surfaces flat below and cambered above. For a similar reason, any decrease in the weight of the elevator or in the distance from its center of gravity to the hinge is very beneficial. The design of control and stabilizing surfaces offers, both from the structural and the aerodynamic standpoints, a fruitful field for experimental and theoretical research, and there is no point at which such research is more needed.

Machines properly balanced with open throttle are all nose-heavy when gliding, and, conversely, those which are properly balanced when gliding are tail-heavy with full power. This is due to the effect of the slip-stream on the controls, and it is interesting to note that this effect exists in a marked degree even on the Martin, where only a small part of the tail-surface lies inside of the slip-streams. The most obvious means of counteracting this slip-stream effect is to raise the thrust-line, thereby giving rise to a diving moment when the engine is on full which will counterbalance the stalling moment due to the downward blast of the slip-stream on the stabilizer. The change in elevation of the thrust-line which would be required for complete balancing would, however, be too great to be practicable on machines of ordinary type. In a JN, for example, the thrust-line would have to be raised a little more than a foot with respect to the center of gravity in order that the force curves with open and closed throttle might be identical. It is probable that one reason for the unusually small separation of the several force curves in the Vought is the relatively low position of the C. G. in that machine, although the C. G. is not low enough, relative to the thrust-line, to balance the slip-stream effect very completely. In flying boats, where the C. G. is far below the thrust-line, it is reported by pilots that the moment due to eccentricity of the thrust is more than sufficient to balance that due to the slip-stream effect, and the boats therefore tend to stall when



the throttle is closed and dive when it is opened. This, of course, is more objectionable than the opposite tendency, but the ideal condition would be half-way between, one in which the air-speed with free controls remains constant at a speed slightly in excess of the speed of minimum required power. Progress toward this ideal condition can be made by tilting the engine down at the front, as on the JN4A, or, on a single-engined machine, by increasing the aspect ration of the tail. Tilting the engine-bed causes the angle at which the air strikes the stabilizer to be diminished at the same time that the speed is increased. Here, again, the effect is rather small if the change is kept within reasonable limits. Tilting the engine-bed on the JN 2° had a distinct effect on the spacing between the force curves with open and closed throttle, but the effect was not sufficient to bring the curves to coincidence. Increasing the aspect ratio of the tail is helpful in that it increases the proportion of the stabilizer which is outside of the slip-stream.

In a twin-engined machine, the effect of the slip-stream on the control forces can be reduced either by "toeing in" the engines so that their slip-streams will travel outward and escape the stabilizer, by setting the engines farther apart, or by having the engines rotate in opposite directions, the upper propeller blade moving away from the center of the machine in both cases, so that the tangential component in the slip-stream, or the race rotation, will be upward in that part of the slip-stream (the part nearest the center of the machine) which impinges on the stabilizer and will tend to counteract the downward direction taken by the slip-stream as a whole and due to the downwash of the wings. The first of these three remedies causes some loss of efficiency, although that loss need not be very pronounced, the second involves constructional difficulties and increases the stresses in landing, and the third makes trouble for the engine manufacturer, requiring the making and stocking as spares of an additional series of cam-shafts. In view of the ease with which an adjustable stabilizer can be incorporated on these large machines, it is not probable that any of the devices mentioned above will come into common use. There is, however, no reason why the tail-surfaces on single-engined machines of small and moderate size should not have a somewhat higher aspect ratio than is the case on many such aeroplanes at the present time,—materially higher, for example, than on the JN. Much, if not most, of the extraordinary controllability, maneuverability, stability, and general facility of hanling of the Vought may be ascribed to the section and plan form of its tail-surfaces. By judicious choice of the section and by increasing the aspect ratio of the stabilizer, its efficiency may be so much increased that the area can be considerably reduced. We may then achieve, at the same time, a reduction in total weight, a reduction in the forces on the stick and in the control leads, an increase in aerodynamic efficiency, and a great improvement in stability.

The position of the center of gravity with respect to the wings is, as already mentioned, a very important factor in determining the longitudinal stability of an aeroplane, a forward movement of the C. G. incheasing the stability. The C. G. on the Vought, the stability and balance of which may be considered as ideal, is 30% of the way back on the mean chord. That on the DH4 with the load carried during the tests was 29% of the way back, and the machine was stable except at very low speeds. On the JN4H, with normal rigging and a heavy observer, the C. G. was about 38% of the way back on the mean chord and the machine was markedly unstable. Subsequent changes have reduced the C. G. position coefficient to 32%, under which condition the instability still persists, although it is much reduced in magnitude. The locations of the center of gravity on the LePere and Martin were not determined. It is probable that the C. G. position coefficient on the JN would have to be reduced to about 28% to secure a satisfactory average of stability. The C. G. must be farther forward on the JN than on the Vought in order that stability may be satisfactory. This is due to the greater efficiency of the tail-surafces on the Vought.

Summarized, the conclusions to be drawn from the results of these experiments and from the theoretical analysis are:

1. That tail-surfaces should be of large aspect ratio.
2. That the stabilizer or tail-plane should be larger than the elevator, and that the elevator should be as light as it can safely be made, its center of gravity being kept as near as possible to the hinge.
3. That the tail should be cambered both above and below, the upper camber usually being greater than the lower.
4. That the center of gravity should be from 28% to 30% back of the mean chord.
5. That the thrust-line should be as high as it can conveniently be placed.

Although no scale for indicating the elevator angle at any instant was fitted to any of the three machines tested in Dayton, some idea of that angle in normal flight could be gained in the case of the LePere by observing the position of the balanced portion of the elevator with relation to the adjacent edge of the stabilizer, and, in the case of the Vought, by recording the position of the stick in the front cockpit (by measuring the distance from the head of the stick to the instrument board) and determining after landing the elevator angle corresponding to the observed stick position.

Stability with fixed or locked controls is deduced from the slope of a curve of elevator angle against speed, the method of analyzing this curve being discussed in full in Report No. 70, where it was shown also that the DH4 had a stable curve of elevator angles at all speeds, while that of the JN was stable at low speeds and unstable at high. While it was impossible to make any exact measurements in the cases of the Vought and LePere, it was evident that the first of these machines would possess a small, but amply sufficient degree of stability with locked, as with free, controls. The LePere would be substantially neutral with locked controls and open throttle, stable with closed throttle, as the position of the stick for straight flight with open throttle is, as nearly as could be detected, the same for all air-speeds.

On the Vought, the angle of the elevator to stabilizer, with open throttle, ranged from +1° at low speeds to +3° at high. In gliding, the elevator was pulled up to a negative angle. On the LePere, on the other hand, the elevator was in line with the stabilizer with throttle upon and set about —4° to the fixed surface when the throttle was closed. These figures have an interesting bearing on the tail-heaviness of the LePere.

Tail-heaviness ordinarily means that there is an upward air force on the elevator, and that the moment of this force about the hinge is more than sufficient to balance that of the weight of the elevator. Naturally, such a machine requires a positive elevator angle for equilibrim. The LePere, on the other hand, although it is extremely tail-heavy, carries the elevator at a zero or negative angle, for equilibrim having the trailing edge of the elevator pulled up considerably higher in normal flight than does the nose-heavy JN. This, also, is in spite of the fact that the angle of zero lift for the JN tail-surfaces would be smaller than for the symmetrically cambered tail of the LePere. To take another instance, the DH4, with a tail having nearly the same section as that of the LePere, is nose-heavy at all speeds if the stabilizer be so adjusted that the elevator angles are equal to those on the LePere. With the stabilizer adjusted for proper balance, the elevator has to be pulled down to a positive angle of from 2° to 4°, whereas on the LePere it has to be pulled up to a negative angle to the wings and the machine is still tail-heavy. The stick forces required to balance the weights of the elevators are substantially equal (within 1 lb.) on the DH4 and LePere.

The conclusion is that the measurements of forces and angles on the LePere, if interpreted in the ordinary way, lead to diametrically opposite conclusions, and that the two sets of data can only be reconciled by taking account of the balancing portion of the elevator hitherto ignored.

Since the center of pressure of a flat plate or symmetrically cambered surface approaches the leading edge as the angle approaches zero, it is evident that, if such a surface be hinged anywhere back of the leading edge, the curve of C. P. travel will cross the line of the hinges at least twice during the range of angles normally used. Such a surface is used on the LePere, and, when it is observed that the balancing portions are in a position where they carry a much larger unit pressure than any other part of the elevator, it appears highly probable that the elevator is overbalanced under some conditions. If this be the case, it would fully account for the seeming anomaly in the control forces, as the effect of tail-heaviness may be produced by a down load with the center of pressure forward of the hinge, quite as well as by an up load applied behind the hinge.

In view of the difficulty experiecnced with the balance of the LePere fighter and of the considerations just stated, I strongly recommend that the effect of eliminating the balancing part of the elevator and adding that area to the stabilizer be tried.

INCREASE IN MAXIMUM PRESSURES PRODUCED BY PREIGNITION IN INTERNAL COMBUSTION ENGINES

By S. W. Sparrow
Automotive Power Plant Section
BUREAU OF STANDARDS

"Technical Note of the National Advisory Committee for Aeronautics"

WITH the high compression ratio of the aviation engine, preignition is of frequent occurrence. That extremely high temperatures are a result, is fairly well recognized, but little attention seems to have been given to the pressures that prevail in the cylinder under these conditions. It need scarcely be pointed out, however, that accurate knowledge of the maximum pressure in the cycle is essential to the design of an engine that shall have a known factor of safety.

In the course of the investigation of the effect of compression ratio on altitude performance, which is being conducted for the National Advisory Committee for Aeronautics at the Bureau of Standards, the curves shown on Sheet No. 1 were obtained. The dotted line shows the pressure obtained with the engine operating normally, the solid line those obtained during preignition. A change of spark plugs was the only difference in engine conditions between the two runs. It appears that the charge is completely burned early in the compression stroke. It is then compressed and because of the loss of heat to the walls of the combustion chamber the first part of the expansion line falls below the corresponding compression line. As a result, the negative work of the first part of the expansion stroke is nearly equal to the positive work at the latter end, making the effective work of that cylinder practically zero.

Although the substance dealt with is not a perfect gas, the equations used in the following computation are sufficiently accurate to explain the pressure increase:

Let V_1, P_1 and T_1 be the volume, absolute pressure and absolute temperature at the beginning of the compression stroke, V_2, P_2 and T_2 corresponding values at the end of the compression stroke, and V_3, P_3 and T_3 corresponding values after the charge has been burned at constant volume. For the 8·3 compression ratio used, if we assume the value of "n" as 1.3 in the expressions

$$P_2 = P_1 \left(\frac{V_1}{V_2}\right)^n \quad \text{and } T_2 = T_1 \left(\frac{V_1}{V_2}\right)^{n-1}$$

Then $$P_2 = P_1\ (8.3)^{1.3} = P_1\ (15.7)$$
$$\text{and } T_2 = T_1\ (8.3)^{0.3} = 1.89\ T_1$$

If the absolute temperature at the beginning of the compression stroke is 350°C, the final temperature T_2 will thus be 662°C. Now assume the firing of the charge to result in a temperature increase in the mixture of 2000°C· (This value is chosen small to allow for any dissociation, heat loss to walls, etc., that may exist·)

$$\frac{P_2V_2}{T_2} = \frac{P_3V_3}{T_3} \qquad V_2 = V_3$$

$$P_3 = \frac{T_3}{T_2} P_2 = \left(\frac{2000 + 662}{662}\right) P_2 = 4 \,.\, P_2 = 4(15{\cdot}7)\,P_1 =$$
$$= \underline{\underline{62.8\ P_1}}$$

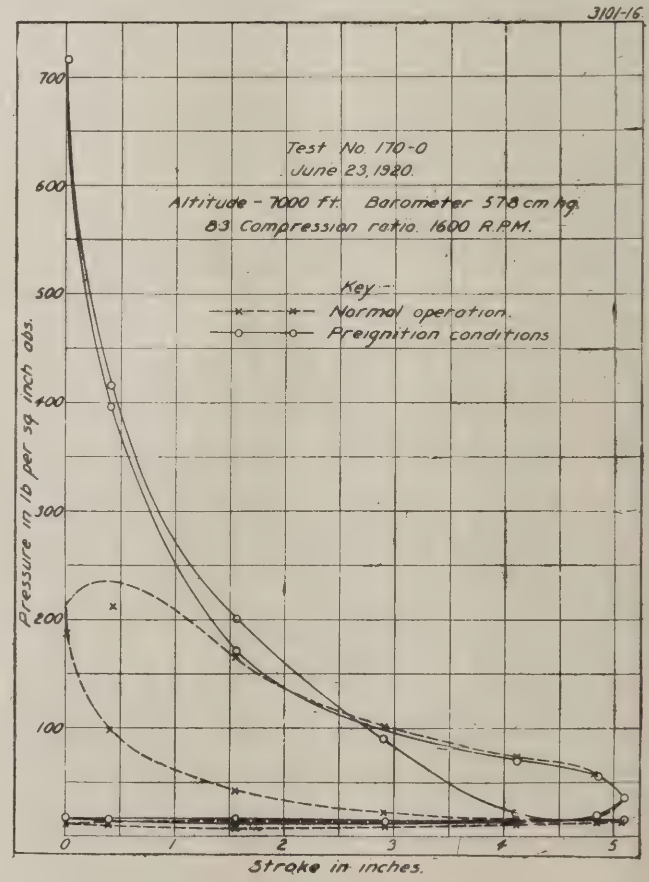
In assuming the charge to be burned at the beginning of the compression stroke, let P_3, V_3 and T_3 represent the condition after the charge is burned at constant volume, but before it is compressed, P_2, V_2 and T_2, as before, representing the condition after the compression.

$$\frac{P_1V_1}{T_1} = \frac{P_3V_3}{T_3}$$

$$V_1 = V_3$$

$$P_3 = \frac{T_3}{T_1} P_1 = \left(\frac{2000 + 350}{350}\right) P_1 = 6.7\ P_1$$

$$P_2 = P_3\ (8.1)^{1.3} = P_3\ (15.7) = (6.7)\ P_1\ (15.7) = \underline{\underline{105.P_1}}$$



No attempt has been made to calculate accurately actual pressures or temperatures, but merely to show why the pres-

(*Concluded on next page*)

HINTS ON FLYING RIGHT HAND TRACTORS

(1) Look over machine in general way.

(2) Be sure of gasoline, oil and water.

(3) Test motor for evolutions.

(4) Be sure controls are working properly.

(5) Start off full power directly into wind.

(6) Watch your direction carefully and contract with right rudder the machine's tendency to turn to the left, due to the propeller's air blast striking the left side of fin more forcibly than the right side.

(7) After attaining a few feet headway, raise the tail with controls and keep it in this position to prevent machine from leaving the ground until it is well past its minimum flying speed, at the same time watching your direction carefully. If your course permits keep your machine on the ground until its maximum ground speed is reached. Then, very easily and smoothly, take it off the ground. By following the above plan of a high speed take-off a large degree of safety is assured for if engine trouble develops soon after, you have surpassed the machine's minimum flying speed and you have a good chance to pick a landing spot that would not be possible if the take-off were made at slow speed, for the machine would immediately start sinking on loss of power and also lose its controllability to a large degree.

(8) The most dangerous place for engine failure is just after leaving the ground.

(9) When once under way it is advisable to attain a safe altitude as soon as possible, and it will be found that the best results can be attained by a high speed, low-angle climb rather than a slow speed, large angle. A steady, fast climb is the best for all purposes.

(10) After a height of not less than 800 feet, a turn can be contemplated. It is advisable to reach a higher altitude if possible, but do not attempt one lower unless necessity demands to miss obstructions or to play safe on a certain forced landing spot in case of engine trouble.

(11) Never forget that the engine may stop, and at all times keep this in mind and plan on a safe landing place within gliding distance of wherever you may be. If you are still on the climb and wish to make a rather short turn, nose the machine over until you are flying level so as to keep the speed high. At the same time bring to play the rudder and ailerons in the correct proportions and in the proper directions to give a smooth, even turn. A large, easy turn with little bank is more to be encouraged than short, sharp ones, using a steep bank, for if banking is not properly done either skidding or side-slipping develops, both of which, if carried too far, are very dangerous. At no time let your machine attain a high angle of climb, for in so doing you are encouraging it to stall which would necessitate considerable altitude to recover from safely. At all times remember that although you are controlling the actions of the machine it has a considerable amount of stability itself, and be a little free with the controls rather than stiff and rigid.

(12) Do not at any time jerk the controls, but be firm and steady and above all smooth in their operations. This forms a quiet and confident mind which is invaluable in flying, also it reduces the strains on the machine to the minimum. Now that a safe altitude has been reached your anxiety diminishes, for with eight there is safety; but remember to keep within gliding distance of a landing place.

(13) Directions of wind here enter on the gliding possibilities of your machine, for although at all times you go the same rate of speed through the air your relations with the ground change with the wind, so if you have to glide into a wind you cannot glide as far over the ground from a given height as you can if the same wind were behind you. You will also notice by flying in a side wind that in order to keep a straight course over the ground the machine must be swung around into the wind on an angle depending on the velocity of the wind. This is to offset the drift of the machine.

(14) Drift must also be counted on in making turns, for by side drifting the horizon appears to be moving in the opposite direction, which is very apt to mislead one as to his actual turning from the result of the rudder.

Landing

(15) When within the correct distance for a glide of medium velocity to your contemplated landing place, shut off the engine and nose machine over to the proper gliding angle and head for the field in a direction to bring you directly into the wind. If you find you are too close to the field and your machine is developing excessive speed, start "S-ing" to reduce your speed as well as altitude. If you have considerable altitude to spare an easy spiral may be executed, but neither of these should be tried unless you are perfectly confident of their success. The best way is a long, straight glide into the field, and it gives one a fine chance to judge distance and wind.

(16) Never glide too flat for your speed falls off and you settle instead of glide down. In so doing your controls become inactive to a large degree, and this must be avoided in all cases. A strong blast must be on all controls in the correct direction at all times to have the machine sensitive to their movements. When you have glided toward the field and are still about fifty feet from the ground you should start leveling off, but gradually allow the machine to glide down within about six feet of the ground where the final leveling off begins. At this point the machine is skimming along, neither rising nor falling, until its velocity wanes, then as it sinks you increase the wings' angle to the air so as to bring the lift again up to the weight of the machine for its loss in speed. As the speed lessens the angle should increase more rapidly until the machine is flying in the correct position for landing at its minimum flying speed. At this point the machine should be just grazing the ground with its wheels and tail skid. Only practice will perfect landings, for it's only a combination of good judgment of distances and speeds.

(17) In making turns you will notice the marked tendency of the machine to nose down on a right-hand turn and to climb on a left one, the latter not being so noticeable as the former. These peculiar actions of the machine are caused by the gyroscopic force of the revolving propeller and must be compensated by the elevators to keep the machine level. In banks of over 20 degrees the rudder and elevators begin to exchange their proper actions with one another until the vertical is reached, when the change is complete. This must be clearly understood, for to expect the elevators to control the horizontal balance of the machine when on a steep bank and the rudder to control the direction of same might end disastrously.

(18) The most common danger at present to new students is the spinning nose dive or tail spin. Although it is not dangerous to the man who knows how to get out of one, it is very wise for the beginner to stay well away from the possibilities of having the chance to see if he ways of getting started on a spin, but excessive banking with considerable rudder on seems to be the foremost way of all. In turning, if the nose falls due to stalling or some other cause, a spin may develop. In a spin the ailerons and elevators are useless, for the air blast strikes them from the side instead of straight on. The only available control is the rudder, and this is your best friend. All the possible rudder should be put on in the opposite direction than you are spinning even if you have to put both feet on one side of the rudder bar. Remember to hold that rudder and keep the motor going full to supply all the possible air blast. This is the only remedy and if you have enough altitude you have nothing to worry about. The centrifugal force of the revolving machine must first be stopped and this takes place somewhat slowly, but as soon as you feel the rudder acting you will feel your elevators and ailerons regaining their control, whereby you can complete the work started by the rudder and regain your proper balance.

(Continued from preceding page)

sures obtained during preignition should be much greater than those during normal operation. The amount of this difference is, of course, influenced by the amount of dissociation, loss to combustion chamber walls, etc. Even Curve Sheet No. 1 does not adequately represent the magnitude of these pressures because with the high temperatures produced the amount of charge taken into the cylinder is somewhat decreased.

At 15,000 feet altitude where the maximum normal pressure ever obtained was 360 pounds per square inch, pressures of over 950 pounds per square inch were obtained during preignition.

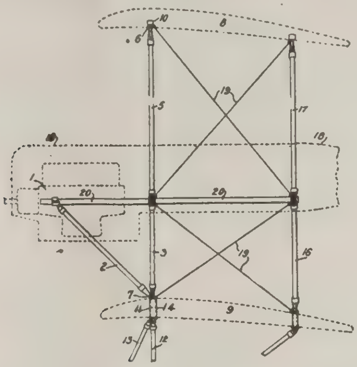
The importance of making every effort to avoid preignition is apparent. Most important of all, however, is that the engineer realizes how much the pressures may be increased from this cause and governs the engine design accordingly.

The accompanying photograph will serve to add emphasis to this statement and explain why these experiments were temporarily interrupted.

July 7, 1920.
Bureau of Standards,
Washington, D. C.

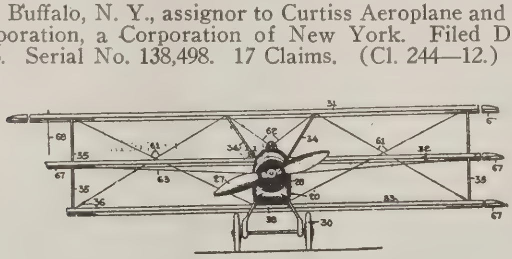
RECENT AREO PATENTS

1,317,591. DETACHABLE POWER UNIT FOR AIRCRAFT. Frederick Handley Page, London, England, assignor to Handley Page Limited, London, England. Filed May 12, 1919. Serial No. 296,611. 5 Claims. (Cl. 244—31.)



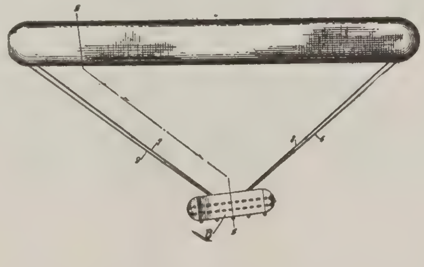
1. In an aircraft having planes, a cradle adapted to support an engine with its auxiliaries, said cradle comprising a skeleton strut of diamond form with apices at top and bottom, means for detachably securing said top apices to the upper plane and means for detachably securing said bottom apices independently of the plane structure directly to a landing gear below.

1,316,278. TRIPLANE SPEED-SCOUT. Glenn H. Curtiss, Buffalo, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, a Corporation of New York. Filed Dec. 22, 1916. Serial No. 138,498. 17 Claims. (Cl. 244—12.)



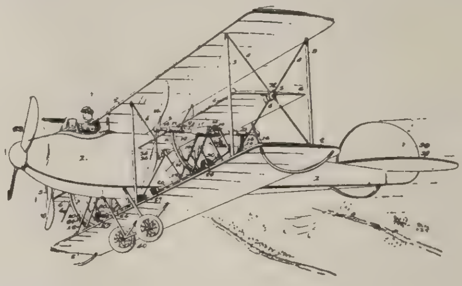
1. A wing structure for aeroplanes including three or more relatively fixed supporting surfaces, wing posts rigidly connecting adjacent supporting surfaces, and wiring for the wing structure connecting non-adjacent supporting surfaces, the wiring being intermediately located between the leading edges and trailing edges of the supporting surfaces and with the wing posts constituting a rigid truss whereby the total number of supporting surfaces is fixed relatively to each other.

1,315,084. HEAVIER-THAN-AIR AIRSHIP. George Coleman Brown, Dallas, Tex. Filed Feb. 27, 1918. Serial No. 219,466. 1 Claim. (Cl. 244—3.)



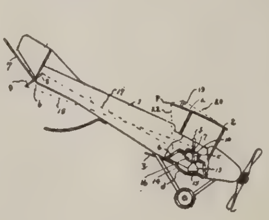
A heavier-than-air airship comprising a substantially cylindrical gas container having an elongated flat bottom face constituting a plane, the ends of the container being pointed and the width of said container being approximately one-fifth the length thereof, a car below the container, said plane being inclined downwardly and forwardly, relative to the car, at an angle of from five to fifteen degrees, cables connecting the sides of the front portion of the plane to the sides of the front portion of the car, longer cables connecting the sides of the rear portion of the plane to the sides of the rear portion of the car, means for pulling successively upon one front cable, the diametrically opposed back cable, the other front cable and the other back cable thereby successively to raise the corners of the car relative to the plane, and for releasing said cables successively immediately after the pulling action, thereby to allow the corresponding portions of the plane to rise under the action of the gas, the forwardly and downwardly inclined plane acting, through such movement, to produce upward and forward flight.

1,309,710. AEROPLANE. Jean F. Webb, Sr., New York, N. Y. Filed Nov. 14, 1917. Serial No. 201,979. 17 Claims. (Cl. 244—29.)



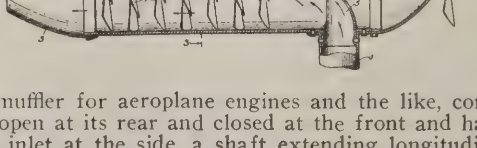
2. An aeroplane having a fixed sustaining plane structure and a main propeller structure and power plant, combined with an auxiliary sustaining plane structure disposed parallel to the fixed sustaining plane structure, an auxiliary propeller structure disposed in a plane parallel to that containing the main propeller, and means for sustaining said auxiliary plane and said auxiliary propeller structure pivotally on an axis transversely of the aeroplane, and means for inclining said auxiliary plane and said auxiliary propeller structure on the pivotal axis.

1,310,619. FLYING MACHINE. Charles M. Heig, Omaha, Nebr. Filed Feb. 13, 1919. Serial No. 276,707. 9 Claims. (Cl. 244—29.)



1. An improvement in a flying machine having an elongated body provided transversely with a stationary plane having a pair of wings pivotally mounted thereon, and also provided transversely with a pivotally mounted plane rearwardly of said stationary plane, a pendulum provided at its distal end with a hood, said pendulum being mounted between its ends within and adapted to swing transversely or longitudinally from the medial plane of said body, an annular, concaved bearing-plate below the mounting of the pendulum a ball on said bearing-plate within the hood, means connected with the pendulum and wings of the stationary plane whereby said wings will be moved by a swinging movement of the pendulum transversely of said body, and means connected with the pendulum and pivotally mounted plane whereby said last named plane will be moved by a swinging movement of the pendulum longitudinally of said body.

1,318,996. AEROPLANE ENGINE MUFFLER. Frank J. Hauman, Bay Shore, N. Y. Filed June 5, 1918. Serial No. 238,334. 3 Claims. (Cl. 121—116.)



1. A muffler for aeroplane engines and the like, comprising a body open at its rear and closed at the front and having an exhaust inlet at the side, a shaft extending longitudinally of the body and out of the front thereof, fans on the rear portion of the shaft, and a windwheel on the front end of the shaft for rotating the same.

NAVAL and MILITARY AERONAUTICS

A Commencement That Was Nearly a Finish

The Engineering Division of the Air Service has been conducting an engineering school at McCook Field for the past ten months. A number of field officers of the Air Service have been attending this school. The final exercises at the close of the school consisted in taking the entire class aloft two at a time and letting them have the thrill of a parachute jump. The Martin Bomber was the airplane employed as the commencement rostrum, and the "speeches" were all delivered (altho unheard) from an elevation of 2,500 feet. Graduating or rather catapulting the class in this way consumed practically the entire day. Towards the end of the day Col. Benedict was one of a pair taken up, and like the insomnia stories sometimes heard, stepped off the wing of the airplane at the proper signal into—space. Space and lots of it, for when Col. Benedict essayed to look about a bit he discovered that unlike Halley's Comet he had no tail, and that his teammate was not in his class at all for speed. Col. Benedict's 'chute had not opened. Sensing the rapid approach of the Miami River he quickly pulled the second parachute and approached China more in accordance with the printed directions and negotiated the last 500 feet in ease and undoubtedly greater comfort.

Army Air Service Schools

Without doubt the Army Air Service Schools are among the finest technical schools in the country. So much interest has been exhibited in them that the following curriculum and syllabus of trades taught at the Air Service Mechanics' School at Kelly Field, Texas, is given as an example of the thorough and complete nature of this work. All of these courses are either in operation or are ready to function.

CURRICULUM AND SYLLABUS OF TRADES

Course for Engine Mechanics

	Hours
Applied Mechanics	128
Battery and Magneto Ignition	64
Overhaul, Adjusting and Repair	192
Testing, Cranking and Trouble Shooting	64
Installation and Testing	64
Advanced Field Training	64
Total	576

Course for Airplane Mechanics

Airplane Repair (Woodwork, Metal Work, Wire Work, Wing Repair, Fuselage Alignment, Fabric Work, Propeller Repair)	192
Engine Overhaul and Adjustment	96
Installation, Testing, Cranking and Trouble-Shooting	96
Rigging and Alignment	128
Advanced Field Training	64
Total	576

Course for Auto Repairmen

Engine Mechanics, including Overhaul and Adjusting	128
Ignition and Carburetion	64
Transmission, Differential, Clutch, Starting, Gears, Axles	64
Chassis, Overhaul and Adjustment	64
Road Work, covering Driving and Road Trouble-Shooting	64
Vulcanizing	64
Motorcycle Overhaul, Adjustment and Repair	64
Field Maintenance	64
Total	576

Course for Machinists

Elementary Mechanics	32
Bench Work (Hand)	64
Drill Press Practice	32
Lathe Practice	64
Shaper Work, Milling Machines and Grinding Machines	96
Gasoline Engine Mechanics	32
Furnace Work and Annealing and Tempering	32
Machine Repair	32
Advanced Machine Shop Practice	128
Machine Shop Maintenance	64
Total	576

Course for Electricians

Technical Electricity	64
Motors, Transformers and Generators	128
Interior Wiring and High Lines	64
Telephony and Telegraphy	64
Electrical Instruments, incl. A. C. and D. C. Switchboards	64
Storage Batteries, Starting and Lighting Systems and Ignition Systems	128
Advanced Field Maintenance	64
Total	576

Course for Blacksmiths

Blacksmithing	128
Forging and Welding	64
Rough Tool Making	64
Oxy-Acetylene Welding	96
Electric Spot Welding	32
Furnace Tempering and Annealing	64
Advanced Tool Making and Shop Practice	64
Advanced Field Maintenance	64
Total	576

Course for Aircraft Armament

Marlin Aircraft Gun, including Shop and Range Work	64
Lewis Aircraft Gun, including Shop and Range Work	64
Browning Aircraft Gun, including Shop and Range Work	64
Fire Control Gears and Range Sights	32
Bomb Releases	32
Ammunition and Pyrotechnics	32
Camera Guns and Small Arms	32
Advanced Field Training	64
Total	384

Course for Instrument Repairmen

Technical Electricity and Principles of Physics	64
Calibrating, Connecting and Reading Electrical Instrument	64
Elementary Mechanics and Shop Practice	64
Pressure Measuring Instruments	32
Temperature Measuring Instruments	32
Directional Indicating Instruments	64
Air Speed Indicating Instruments	32
Time Indicating Instruments	32
Revolution Indicating Instruments	64
Installation of Instruments and Review	64
Advanced Field Maintenance	64
Total	576

Course for Parachute Repairmen

Folding Parachutes	32
Parachute Repair and Maintenance	32
Testing and Field Work	32
Total	96

Course for Army Paperwork and Stenography

Army Paper Work	75
Typewriting	166
Shorthand	66
English	75
Spelling	25
Study and Application	233
Total	640

Course for Engineer Officers

Carburetion and Ignition	32
Mechanics of Gas Engines	64
Cranking, Testing and Trouble Shooting	32
Mechanics of Airplane Construction and Repair	32
Motor Installation and Testing	32
Rigging and Alignment	24
Engineering Forms	8
Parachute Maintenance and Repair	32
Total	256

Instruction in the following trades has not been authorized to date, but has been incorporated in the courses new being carried on:

Carpentry and Cabinet-Making, Coppersmith, Fabric Work, Magneto Repair, Metal Work, Motorcycling, Propeller Work, Vulcanizing, Welding.

The Training Department personnel of this school consists of 9 officers, 21 enlisted instructors, 56 civilian instructors, and 393 students—14 of which are student officers, 8 student officers are attending the course in aircraft armament and 6 the engineering course.

It is the aim of this school to train air service personnel properly. The cooperation of all air service stations is solicited in selecting good material among their enlisted men for courses at this school.

FOREIGN NEWS

London to Copenhagen in Five Hours Forty Minutes

Another record has been set up on the London-Copenhagen Air Mail Route. Lieutenant Vaughan Fowler left the Handley Page Aerodrome at Cricklewood one day last week, and with only one stop at Amsterdam reached Copenhagen in five hours, forty minutes total flying time from London. The previous record was six hours, five minutes.

Progress of Aviation in Germany

According to advices received from Berlin, transatlantic airships are to be accommodated in the Isle of Norderney off the coast of Prussia. Norderney has been selected as being most convenient of access to the huge international aerodrome which is projected for Bremen, the distance of 80 miles bringing it well within one hour's time of that port by aeroplane service. Five hundred workmen are to be employed for a period of six months in preparing the Bremen aerodrome and the German Government has already signified its desire to co-operate by offering a certain proportion of the official out-of-work funds towards wages with a view to secure useful work for the unemployed.

Handley Page Reduces Freight Rates

On and after Friday, October 1st, 1920, the freight rates for goods carried on the Handley Page Air Services between London-Paris and London-Brussels and vice versa, will be further reduced as follows:

From London: Up to 100 lbs. 1/3 per lb.; over 100 lbs. 1/– per lb.; minimum 2/–.

To London: Up to 50 kilo 7 frs. per kilo; over 50 kilo 6 frs. per kilo; minimum 5 frs.

Naming Dirigibles in France

The Zeppelin "L-72," handed over to France, has been renamed, it having been decided that the designation DR 1 was not in accordance with French practice, which gives names to airships. It is in future to be called the Dixmude, thus recalling the magnificent work of the French marine fusiliers in defence of that town in October and November, 1914.

Flying from Formosa

From a report emanating from Tokyo it appears that a scheme is being considered in Japan for the establishment of an aerodrome at Mako, on the Island of Formosa, which should serve as a base for an aerial service to South China and the South Sea Islands. The project also contemplates the starting of a laboratory for aeronautic research at Mako, and also an aerial police force for the Island itself.

Air Mails in Spain

By way of explaining why the air mail between Barcelona and Palma, which was to have started in July, has not yet materialized the Spanish Government has issued a note stating that tenders for the service were limited to Spanish companies, with a view to promoting home industries; up to the present, however, no Spanish firm has come forward. The Spanish postal authorities refuse to accept any responsibility for the delay in starting the service.

Amsterdam-London and Back in One Day

Major Foote recently demonstrated that by the Handley Page service it is possible to leave Amsterdam at 8.30 a. m., reach Cricklewood at 11.25, spend five hours in London, and starting on the return at 4.25 p. m., be back in Amsterdam at 7 p. m. At any rate that was his time-table on a recent occasion; not only so but the following morning he left Amsterdam at 11.35 a. m. and landed at Cricklewood at 2.35 p. m. with the mails. The same aerial limousine, with Rolls-Royce engine, was used throughout.

The Schneider Cup

After the withdrawal of the French and British challenges for the Coupe Jacques-Schneider, there only remained the Italian team, and the recent works upheaval in that country seriously interfered with the intentions of competitors. As a matter of fact the only competitor to undertake the navigability test on September 18 was naval Lieut. Bologna on a Savoia. He attempted to fly over the course on the following day, but owing to the squally wind gave up after covering five rounds. He, however, made another attempt on September 22, and then covered the full course of 375.560 kiloms. in 2 hr. 10 min. 35 secs. He was declared the winner of the trophy, which therefore remains in Italy for another year.

King Victor Inspects "L.61"

Previous to taking a trip in the new Italian airship "Roma," King Victor of Italy inspected "L.61," the Zeppelin recently surrendered by Germany to Italy. It is reported that previous to making the voyage to Italy, the "L.61" carried 85 passengers during a trial trip lasting 10 hours at a height of 2,500 meters. The journey from Friedrichshafen to Rome took 12 hours, and to cross the Alps the airship had to rise to 3,500 meters. On arrival at Rome it was found that the shed was only 15½ ins. higher than the airship, but the vessel was docked without mishap.

Fire at Martinsyde's

The aeroplane works of Martinsyde's Ltd., at Woking, were seriously damaged by fire on October 25. The fire was prevented from reaching the petrol store. A few out-of-date aeroplanes were destroyed, together with 127 wings of aeroplanes, but the motor-cycle factory did not suffer much.

Mr. Campkin, the secretary of tbe company, states that there will be no unemployment as a result of the fire.

Italian Air Service

A regular air service is in operation between Milan, Turin and Bologna. Aeroplanes fly every Monday, Wednesday and Friday. Services are projected between Rome and Milan and Brindisi-Athens.

The Aircraft Competitions in Britain

Aeroplanes are undoubtedly going to play a very prominent part in commercial enterprise in the near future, and much is expected from the results of the competitions arranged by the British Air Ministry which began on 3rd August. Substantial monetary prizes are being given by the Government. and the further offer to purchase the best three machines in each section should add another inducement to competitors and compensate them for their initial expenses. The tests for seaplanes will commence in September.

The competition has been divided into two classes:—

(1) Small types with seating accommodation up to six persons, including the crew.

(2) Large types with seating accommodation for seven or more persons, including the crew.

The passenger accommodation of the amphibians has been limited to two, exclusive of the crew. Naturally, airworthiness is a primary condition with all machines. In the aeroplane tests, marks are given for speed, landing, getting off, reliability in flight, economy in operation, and general features.

The high-speed test required machines to fly at the rate of 100 miles an hour at least, while the conditions of the slow-speed reduced the rate to a maximum of 45 miles per hour.

In the landing test, small machines have to get off, and land, within 175 yards, an extension of another 100 yards being allowed for the large types.

From a fixed mark, machines have to taxi 175 to 275 yards according to the type, and fly over the mark as high as possible, the actual height being judged photographically.

The reliability and economy test consists of two consecutive flights of 3½ hours each in which an air speed of 80 miles per hour with a full load on board had to be attained. An hour must elapse between the two flights, during which the machines are not touched.

In all flights, multi-engined machines must shut off one engine.

When the amphibian competitions commence the tests will be practically the same as in the aeroplane class, with the addition of trials carried out over the sea, and taking off and landing on the water.

Although firms of international repute are the principal competitors, they jealously guard their technical secrets from premature exposure, and particularly so in the amphibian section, and many suprises are anticipated at the September competitions. The Central Aircraft Company, though responsible for the manufacture of many aeroplanes, has not had the same amount of publicity as the other competitors, and in consequence is regarded in the light of an unknown quantity.

Capable of carrying 15 passengers, and with a speed of 115 units per hour, is the well-known W.8 machine of Messrs Handley Page; while Messrs. Vickers have entered a "Vimy," with seating accommodation for 11 passengers, and a speed of 100 miles per hour.

Among the smaller types is the "Kestrel," a smart-looking two-seater, made by the Austin Motor Company, with a 200 h.p. engine by Beardmore. This machine has the extraordinary low landing speed of 35 miles per hour, and the pilot and passenger sit side by side. Messrs. Petter's Westland "Limousine," with a 450 h.p. Napier engine, has accommodation for five passengers. The most popular entry is the four-seater commercial triplane of Messrs. A. V. Roe, with a cabin constructed on the pattern of a railway carriage. The public appear to prefer this to any other saloon, presumably on account of its homely appearance.

These tests have obviously been arranged with the view to ascertaining the commercial suitability of each machine, for different qualities are required from those which were considered so essential for war-time manoeuvers, and the competition cannot fail to resuscitate aerial activity, and further enhance our commercial progress. The results, which are not yet available, will be announced in the next issue.

The prominence usually given in the Press to aeronautical accidents gives a false impression of the dangers of aviation. This was demonstrated recently by a dinner given in London to the survivors of the first 100 British pilots. Notwithstanding that nearly 20 years have elapsed since pilots' certificates were first given, the dangers of the war, and death from other causes, no fewer than 75 survivors remained.

Morane and Latécoére Honored

The promotion of Latécoére and Robert Morane to be Chevaliers of the Legion of Honour are honors well earned. The former was the founder of the air service between Toulouse and Casablanca which has been running for two years, while Ronert Morane is the head of the Morane-Saulnier firm.

How Sweden Does It

From a message from Stockholm it appears that the Swedish Government is determined to encourage the development of an aerial postal service. It has decided to subsidize the Swedish Air Traffic Co. by the payment of 500 kronen for each journey between Malmoe, Copenhagen and Warnemunde.

German Prizes for Touring Machines

The Deutsche Luftfahrer Verbandes has offered prizes for the best design of a small single-seater aeroplane, suitable for touring and pleasure purposes. The motive power is not to exceed 10 h.p. A series of prizes are to be offered beginning with 5,000 and 10,000 marks for the most practical idea. Further prizes from 20,000 to 50,000 marks are to be offered until a perfect machine is obtained.

Aviation in Rhodesia

Rhodesia is not only studying the commercial possibilities of aviation, but recently experimental flights have been made between Bulawayo and Salisbury, and Bulawayo and Livingstone. Mails and parcels were carried on each occasion, and the result was announced as a complete success.

Transport in Argentina

Seemingly the rivalry between the various States is speeding up matters aviatic in South America. At any rate the Argentine Senate has passed a Bill granting a concession to an Aviation Company to transport passengers, mails and parcels between the Province of Buenos Aires and Patagonia up to the Magallanes. The Bill also authorizes the issue of a special postage stamp for this service.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

Aerodynamics

STREAMLINE is a study to which the reader should devote his time. To stream line a body is to make it of such form or shape that it will pass through the air with the least possible resistance. This is accomplished by shaping the objects somewhat like a fish. We will take the shark as a perfect streamline body. The nose is sort of blunt, the widest section about one-third the distance back, and gradually tapering to a point at the tail. This allows the shark to move easily through the water, and if this shape is used in the air it is only natural that it is the correct form, because air is thinner than water and a body that will move easily through the water, will move much easier through air.

Figure 1, in the drawings, shows a front and side view of the old Bleriot machine. The reader will notice the lack of streamline throughout the whole machine. In the old days aeroplane designers did not bother much about this problem, they did not even care about enclosing the rear part of the body. The only part covered was the forward part which held the engine, fuel tanks and pilot. This caused a loss of about 50% of the available engine power.

The Nieuport shown in Figure 2 was a new and successful idea in 1911. The body was made deep at the forward section and tapered to a wedge shape at the rear. This little monoplane made a speed record at that time of 68 miles per hour. This showed the designers that it was necessary to cover all exposed parts of the body and cut down the head resistance as much as possible.

The perfect shape for an aeroplane body is shown at Figure 3. This is known as the monocoque type and is constructed from layers of thin veneer wrapped one over the other somewhat like tobacco on a cigar. While this is the perfect shape for a body, the weight is a drawback and for that reason it is not used to a large extent. Our L. W. F. and the German Albatross are machines using this form of body.

The Spad shown at Figure 3 is a fair compromise between the heavy monocoque type and the light built up style in use mostly by aeroplane constructors. It will be noted that there are no sharp corners, and even the cylinder heads have a streamline covering over them. Also take notice of the streamliner directly behind the pilot's head.

This much for the resistance of bodies, we will now take up the proper shape of struts, tail skids, etc.

Figure 5 shows an air stream flowing around a square strut. The reader will notice the air striking the flat entering edge spreads out and curls around closing at the rear and forming a vacuum which holds the machine back.

The strut in Figure 6 has a better shape than the one in Figure 5, and the air passes around it easier, but all the vacuum is not eliminated. Figure 7 is a strut of perfect shape, and you will notice that it passes through the air with very little trouble, the air separating at the front and closing in at the rear without allowing a vacuum to form.

Bracing wires also tend to cut down the speed of the machine, and when you consider that the average aeroplane has over 400 feet of bracing wires exposed to the air currents, it is necessary to do something to lessen this resistance. This can be done by the bracing cables and wrapping at distances of about 12 inches with silk ribbon or linen thread and glue, as shown in Figure 8.

Tail planes in ordinary practice are flat top and bottom. A better way would be to put a slight camber on the top. This would not alone be a better cross section but would give enough lift to take care of its own weight. See Figures 9 and 10.

Planes can also be made to conform to the air currents through which they pass. While the general cross section of wings must be of conventional design, the plan of the wings can be made so the air will flow by at the ends with very little friction.

On the left, Figure 11, shows a wing having square ends. Wind tunnel experiments show that air flowing past a wing tends to curve outward at the ends as shown by the lines in the figure.

To the right, Figure 11, shows a wing designed to take care of the air currents; the reader will note that a triangle has been cut out of the end of each wing. This angle that the ends of the wings form is called the "Rake."

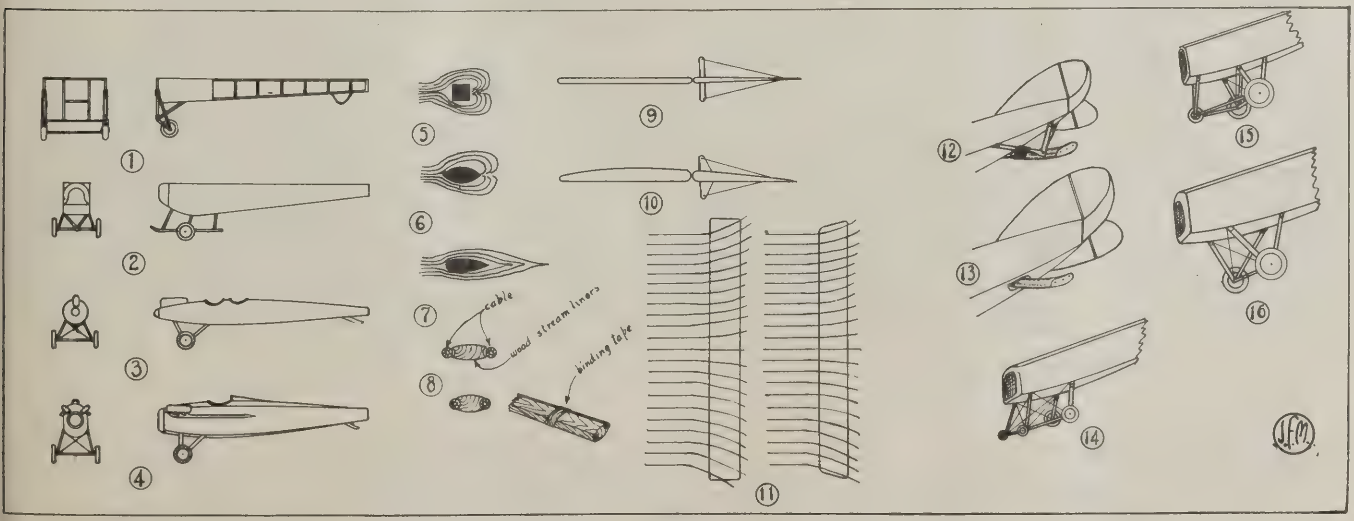
Tail skids can also be designed to overcome resistance; the bad and good designs are shown in Figures 12 and 13.

In Figure 12 is a tail skid of poor design because all the bracing is exposed to the air currents. It would be better to insert it in the body of the machine as in Figure 13, leaving only the end of the skid projecting.

Landing chassis are made in different forms and for various reasons. Figure 14 shows a landing gear of the four wheel type. This type offers great resistance, and is generally only found on training machines, as is the three wheeled type, Figure 15.

The best all around and most used type is the one shown in Figure 16. This type is found on most of the fighting machines.

It would be well for the reader to study this article over and to keep it in mind when planning a model or large machine because every pound of resistance needs an equal amount of thrust to overcome it and the faster the aeroplane travels the greater will be the resistance with a corresponding loss in efficiency of Horse Power.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Right!

I held a hand, so pretty, so dainty and so neat,
I thought my heart would break with joy, so wildly did it beat.
No other hand unto my soul could greater solace bring
For that little hand I held last night was four aces and a king."

Wireless Wanderings

Flat on his back an indolent philosopher held forth on the joys of "wireless travel," as he called it.

"We have been reading about the yacht races reported by wireless telephone. Then comes a successful experiment with transmission of pictures by wireless. Next we will have the wireless movie.

"When that time comes I shall be able to enjoy my penchant for foreign travel without the suffering of sea-sickness.

"I'll hire a movie aeroplane equipped with a wireless motion picture transmitter and start the flyer on his way. I'll lie here on my back and watch the panorama of the earth unfold on a screen mounted on the ceiling.

"When the aeroplane passes over a place that looks interesting I'll signal for the aviator to descend and get close-ups with the wireless movie machine, and start the wireless telephone to working so that I can hear what is going on."

Whether philosophers are optimistic depends on the philosophers. The indolent variety usually are. But even granting the optimism, the forecast is not so impossible as it may sound.

Grandparents of the present generation who might have dared to indulge in speculations of flying, wireless telephony and wireless telephotography would have been considered insane.—*N. Y. Evening world.*

Aeronitis

Too many saddles and horse blankets were bought by the War Department, says a Congressman, exposing the horrors of war-time extravagance. Quite true, sir, quite so; but as we see it the real fault was entrusting them to inexperienced cooks who little appreciated the sweet succulence of a well-done saddle, and oftimes served them practically raw, sir, practically raw, and some of it was served at the Air Service mess, too! Think of it.

Cadet Spriggs—"I think I will send my girl a rifle, bayonet and sword."

Cadet Stolloroff—"Is she in the custom of collecting souvenirs?"

Cadet Spriggs—"No, but she likes to have arms around her."—*Memoirs (R.O.T.C. Camp, Camp Kearny).*

Lady Shopper: "Pajamas, size 36."

Ex-Supply Sergeant (in reverie): "Where's yer old ones? Gotta turn 'em in; gotta see yer old ones."—*The Red Diamond.*

Reve de Guerre

By C. C. Seale, 1st Lt. 135th A. S.

A star-shell and a sniper
A patrol in the stinking dark,
The gas in the soggy shell holes,
And a bullet finds its mark.
The posts and the wire and the shadows,
And the sharp chevaux de frise.
Now I'm looking o'er the cornfields
At those dreary post oak trees.

There's a mist on the far horizon,
The infinite tender sky,
The deep rich roar of a motor
In a plane that's sailing high
And we're over the Meuse or the Argonne,
A reconnaissance at dawn.
But I've got to earn my wages,
Hoe out this row of corn.

When you knew your guns were working
And there's a Fokker in the sun,
And you find him in your Aldis sight,
To the song of a Marlin gun.
But the thing is over and done with,
O! Damn such dreams as these,
For it's "Get up, Bill, it's six o'clock
And we've got to plant those peas."

Down in the Cactus, by the Rio Grande

By Pot. Arthur Lidholm, 8th Aero Sqdn., McAllen, Texas

The famous eighth Aero Squadron, with fifty strong
Waiting for the Spicks to start something wrong;
With the wind against our faces, comes the sand
Down in the Cactus, by the Rio Grande.

While cleaning wings, and polishing struts
From the air we can see the very small huts;
Not knowing where, or when we are going to land
Down in the Cactus, by the Rio Grande.

When on the truck to our swimming pool
After supper, when the air is nice and cool;
See who in the water, would be the first man
Down in the Cactus, by the Rio Grande.

In the midst of the night, laying on our bunks
Bound in thoughts of packing our trunks;
Leaving behind, all cactus and blowing sand
Down in the Cactus, by the Rio Grande.

We deal the cards, to win or lose
Just to be with the boys and booze;
With an automatic pistol in hand
Down in the Cactus, by the Rio Grande.

We have played the game with all our might
And now we begin to see some light;
Since the Eighth has become a reckless band
Down in the Cactus, by the Rio Grande.

We know our steps will never more,
Wander back to a barroom floor;
Or sit around with beer in hand
Down in the Cactus, by the Rio Grande.

Now instead we have the Recreation room,
Where we have the Victrola in place of the piano boom;
With an interesting book, in every man's hand
Down in the Cactus, by the Rio Grande.

AERIAL AGE
WEEKLY

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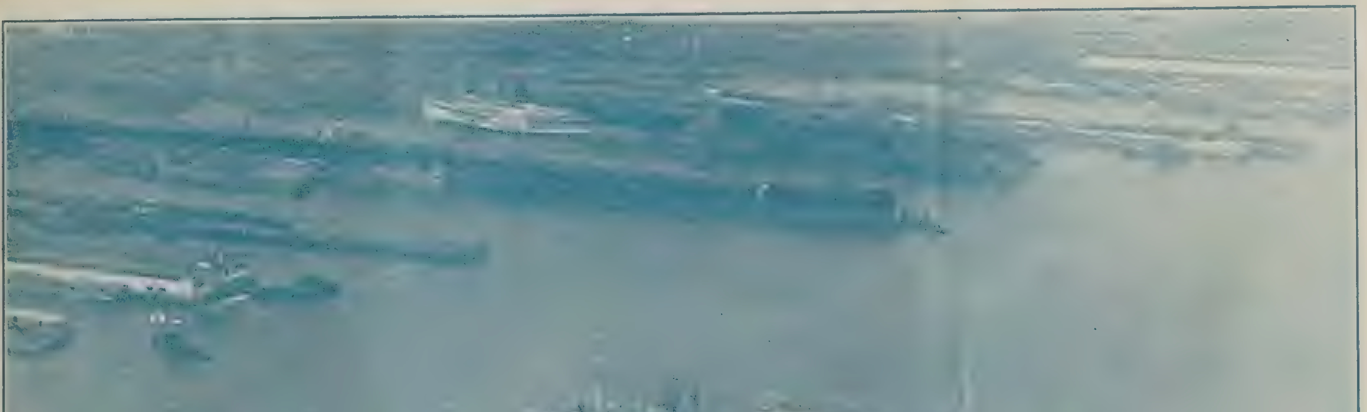

Photograph by U. S. Army Air Service

Airscape of Ellis Island—Headquarters of the Immigration Department in New York

Alaskan Air Pioneers

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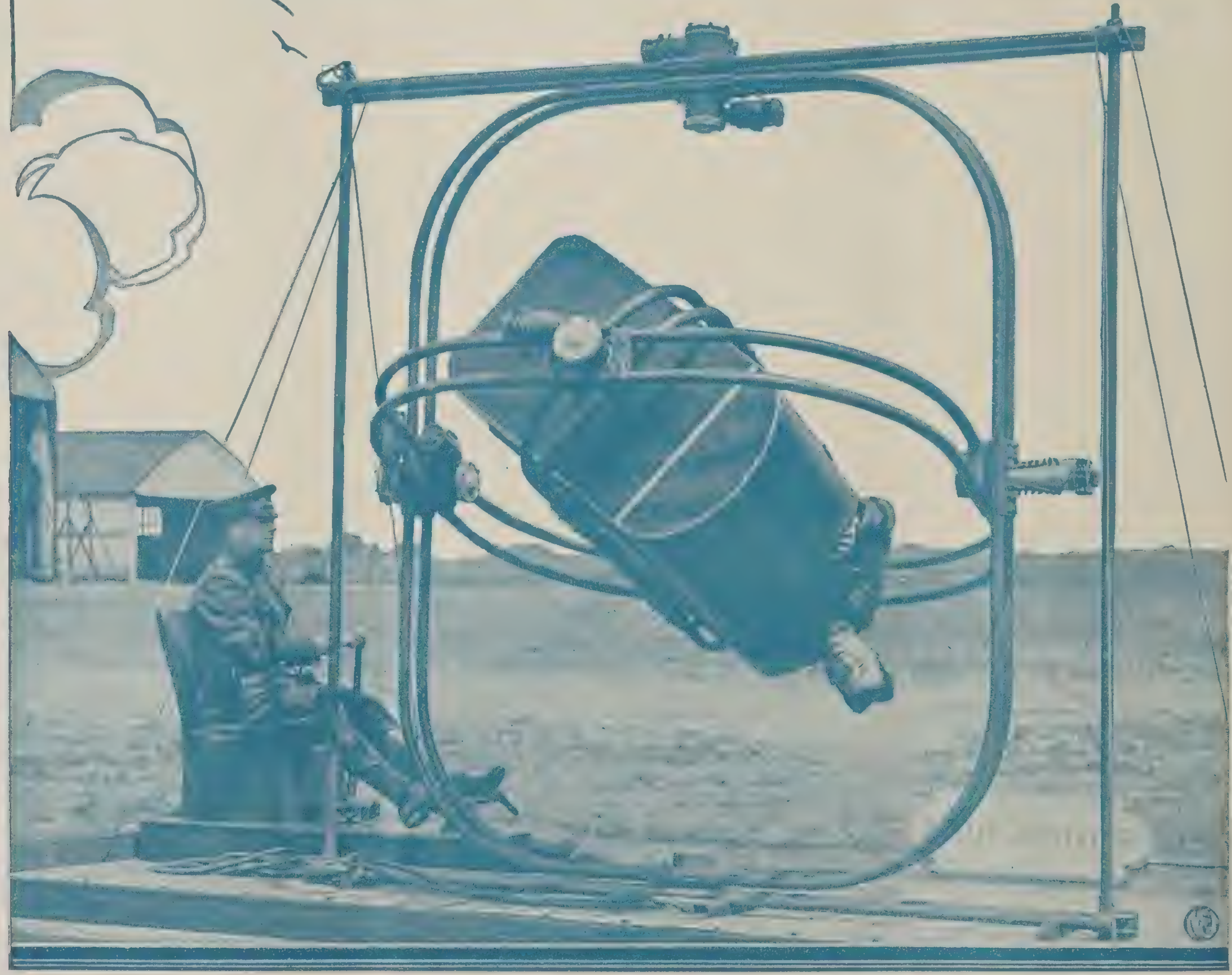

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ALASKAN AIR PIONEERS

ONLY the most daring and perilous, or novel, adventures of the aviators attract notice nowadays. Interest in the practice of flying is at a low ebb in England, and in this country it is the same, which is to be regretted, because the most progressive nation in the development of transportation, not to speak of preparedness for war, will be the nation that takes aviation seriously and promotes it systematically. Is the United States to be such a nation? Not unless such achievements as the flight of the army men to Alaska and back make a deeper impression. It was a most remarkable demonstration of the skill of our pilots, the efficiency of our mechanics, and the ingenuity of our designers and builders. The four machines used by Captain St. Clair Street and his fellow-officers were made-over and improved De Haviland 4s, renamed Gallaudet Havilands.

De Havilands had not borne the best of reputations among the critics, but the four biplanes that were driven to Nome landed on the return to Mitchel Field in such good condition that they were indistinguishable from the thirty planes that rose into the air on October 20 to escort them home. "We never had a missing cylinder on the entire flight," said Captain Street. And they had been taken to the wilds of Alaska and brought back in all sorts of weather, rain, snow, hail, sleet, fog and high winds, as well as fair days. They had been flown over mountains 10,000 feet in altitude and descended into unknown river valleys, traversed hundreds of miles of glaciers and passed over primeval forests. To Nome and back is 9,000 miles. Only the long voyage from England to Northern Australia through the air stands comparison with what the American Army men accomplished. The Cape-to-Cairo flight was not so difficult, not so dangerous.

An Indian chief who saw Street's ship of the air come to earth in the Yukon country exclaimed to the Captain: "You heap smart man, but heap damn fool!" The chief's people had scattered and run to shelter when the biplane came sweeping round a bend in the river. It was some time before they could understand that the visitors were human, and then the risk of sailing through the air in such a heavy machine seemed prodigious to them—so much so that they did not expect to be believed when they told the story to their friends back in the wilderness. The adventure was wonderful, even to the invaders. There is this passage from Captain Street's narrative:

> The trails out of Telegraph Creek were impassable even for horses. Meanwhile we hunted (an axle had broken and there was to be a four days' wait for repairs). Nelson shot a black bear. We dined sumptuously on reindeer meat, caribou and bear. We saw much wild game, at one time we flew over herds of caribou, moose, reindeer and mountain goats. Over the Bering Sea we spotted schools of white whale and hair seal.

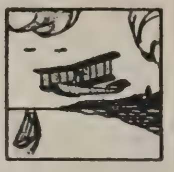
To leave Telegraph Creek the aviators had to climb 12,500 feet to clear the first mountain peak, and then they ran into the "worst snowstorm" they had ever seen. Indeed, there was much bad weather, and the hazards were increased by dependence upon maps that were not of much use as guides sometimes:

> The maps of the Yukon and Alaskan mountains a few miles back from the coast are mere blanks. But we secured much data and a fair number of photographs that will be employed to correct existing maps. The maps of British Columbia, at least over the uninhabited areas, are derived mainly from reports brought in by trappers.

There were some mishaps, naturally, but the worst were a broken propeller and a shattered wing panel. Tires blew out in landing on rough ground where stumps could not always be avoided. The river bars chosen for the end of a day's flying were not always smooth, and they were usually deceptive as the pilot manœuvred to come down. Captain Howard T. Douglas, who had spent three months in preparing landing places, was obliged sometimes to cut down many trees—in fact, to clear primeval tracts. It was what might be called rough going at the best. Far as the distance was to Nome, the actual flying time was only fifty-six hours, but the planes were in the air on sixteen different days, and there were sometimes long intervals between flights, because the weather would not clear up. On the return trip there were fifteen days when the army men could "carry on," and their actual time in the air was about fifty-six hours. The average speed attained was eighty miles an hour.

Alaska is so vast a Territory that building railroads has always been a kind of forlorn hope, to be put off and taken up again by some enthusiast with extraordinary energy. In the back country most of the traveling is done by dog teams when there is any snow, and usually snow abounds. The late Archdeacon Hudson Stuck, the man who climbed Denali (McKinley), has written of Alaska: "If one were to travel continuously for a whole year, using the most expeditious means at his command, and not wasting a day anywhere, it is doubtful whether, Summer and Winter, by sea and land, squeezing the last mite out of the seasons, traveling on the 'last ice' and the 'first water,' he could even touch at all the mission stations." Nine-tenths of Alaska, he has said, is probably destined always to remain an arctic wilderness. In area one-third of the continental United States, the Territory has only 65,000 people. Its vast wealth will never know development unless transportation is furnished beyond the fringes of the country, the few ports and towns accessible from the coast. At the present time the pioneers are "wild" about relief by aeroplane. The visit of Captain Street's squadron has filled their heads with visions of a regular mail service from the south and express and passenger accommodations. In certain seasons of the year it should be practicable, after aerodromes have been built a few hundred miles apart. But it is a storm-bound country in many months of the year, and the problem would have to be worked out thoroughly. At any rate, Congress may expect to receive appeals for aeroplane transportation from the Alaskans soon after it meets.—*Editorial in New York Times."*

THE NEWS OF THE WEEK



Status of Transcontinental Race for Pulitzer Trophy

It is definitely stated by the Aero Club of America that plans for the 1920 transcontinental race for the Pulitzer Trophy have been cancelled.

It is a matter of interest, however, to note that, at the solicitation of the Aero Club, Mr. Ralph Pulitzer has readily consented to make the Pulitzer prize a perpetual trophy for closed circuit races to be contested for annually, in North America. In order to perpetuate the trophy, Mr. Pulitzer will give annually gold, silver and bronze plaques or medals to the winners of first, second and third places, the cup itself to be held for the period of one year by the club whose entrant wins it.

While detailed announcements will be made at the proper time, the Aero Club expects the contest for the Pulitzer Trophy will be run over a closed circuit on September 4, 1921, for a restricted class of planes, requirements to be determined by the Army, Navy, and the clubs contest and technical committees, with the object in view of developing new types of sportsman-training planes, which would be suitable for both land and water flights, and which would, in the event of adoption and large production by the Government, bring the price of the machine within the reach of the sportsman.

The advantage to the Government to be derived from such a race and from such results is self-evident, since it should develop a reserve force of personnel and of machines that would be of immense service in emergency.

Herbert Pulitzer Hurt in French Plane

Paris, Oct. 24.—Herbert Pulitzer, youngest son of the late Joseph Pulitzer, of New York, had a narrow escape when an aeroplane in which he was flying with the French pilot, Marquis des Champes de Boishebert, a former army flyer, and a mechanic, fell, five miles from Dijon. The plane started from Le Bourget Field, near Paris. Mr. Pulitzer suffered abrasions and bruises, but the pilot was pinned underneath the machine and died in a hospital half an hour later.

Mr. Pulitzer returned to Paris and planned to start for London in another aeroplane in the afternoon.

Flies Through Street

Omaha.—William C. Brooks, aviator, of Blair, Neb., was arrested in Omaha October 24 on charges of "reckless driving," after he had completed a thrilling flight through the business district of Omaha. He was released on $1,000 bond. He said he wanted to show city folks what a country aviator could do.

According to Police Judge Foster, Brooks will be tried under a law to prevent jeopardizing life and property usually known as the Runaway Team Law. Nebraska has no ordinance regulating aerial traffic.

Brooks's stunts consisted of flying back and forth for an hour, rushing down between buildings for blocks at a stretch, the wings of his machine almost scraping the buildings on either side of the street, doing nose dives and tail spins to points only a few feet above the trolley lines.

Planes Locate 494 Forest Fires

Aeroplanes of the Army Air Service operating in California and Oregon, doing patrol duty, located 494 forest fires in less than two and one-half months, according to a press dispatch. Fifty-three of these fires were reported by wireless from aeroplanes assigned by the Air Service to cooperate with the Forestry Service in protecting national forests from fire.

Hunting Cattle by Aeroplane

One of the most unique methods of locating stolen animals and of running down cattle and horse thieves that has yet been heard of has been performed in South Dakota.

Around the first of October Sim Jefferies, an aviator flying for the Aberdeen Aero Company, a corporation with offices in this city, was retained by Oscar Orlander, a rancher near Isabel, South Dakota, to help in the hunt for a herd of cattle that had been stolen from his grazing land.

Jefferies and Orlander started in their flight from Isabel and after flying over the surrounding territory for a while they noticed some cattle grazing in a certain locality. They swooped down low over the herd, and Orlander shook his head, his voice could not be heard above the roar of the motor.

Jefferies arose and continued on. Four herds were sighted and each time the same performance was gone through. The fourth herd brought an affirmative nod from the ranchman, and they flew back to the ranch, where Orlander acquainted his cowboys with the find and told them the location of the cattle. The cowmen went to the place and brought the cattle home.

Sixty Graduates at March Field

Flying cadets of March Field, California, who are nearing completion of their preliminary course are being called before an examining board for classification as to their specific qualifications for advanced training. About 60 men in the class will graduate within the month. Orders will then be requested of the Adjutant General for their transfer to pursuit, bombing and observation schools. It is proposed, however, to request that about 30 be retained at this field for a six weeks' course as instructors.

Air Harbor Opened

Montreal.—An air harbor for Montreal has been officially opened by officials of the local branch of the Aerial League of the British Empire. The situation chosen was Bois Franc, on the Cartierville Road, which was formerly a polo field, a tract possessing everything that is desirable for an ideal landing place.

Fire Destroys Seaplanes and Hangars at Washington Air Station

Washington.—Thirteen seaplanes, two hangars and most of the other property at Bolling Field, the naval air station at Anacostia, a Washington suburb, were destroyed by fire October 16. The heating plant, machine shop and parts of six planes were wiped out.

The fire is believed to have been started by defective wiring. Captain T. T. Craven, Chief of the Naval Air Service, ordered an investigation to ascertain the cause.

The flames threatened the destruction of property around. The lives of firemen and employes of the air station were endangered when the fire ate its way around quantities of high-test gasoline stored on the grounds.

Shop Service Profitable

B. C. McClellan, an old-time balloon man at Spokane, Wash., has been more than successful with an aeroplane hospital he established this spring. Since he opened up his shop, he has done repair work on 20 different machines. He has done every kind of work on a plane from

Several twin-motored F5L seaplanes bought from the Navy Department are being used successfully on the Great Lakes. A fleet of the same type is ready for service between Florida points and the West Indies

covering a small hole in the wing fabric to building an entire new wing. Mr. McClellan says his greatest trouble has been in getting supplies with which to fix the planes, rather than difficulty in getting ships to fix.

During the winter months, Mr. McClellan intends to build at least two new planes, one a speedster and one a larger passenger carrying ship. During the last 10 years, Mr. McClellan has designed and built 11 successful aeroplanes.

U. S. Pilot to Try Flight Over Ocean

Warsaw.—Lieut. Carl Clark, of New York City, a member of the Kosciusko Squadron, purposes to fly from this side across the Atlantic alone in an aeroplane.

Lieutenant Clark's plan is to fly in a French Brequet plane constructed with two engines arranged so that they may be controlled by the solitary flyer, using the engines alternately, in order that he may keep them tuned up and know that they are available at any moment.

"I believe I can sustain the nerve strain necessary for the more than sixteen hours of cross-Atlantic flying," he said in a statement made in Warsaw. "At any rate, I am willing to make the attempt. I have two motives—the quite natural desire to be the first aviator to cross the ocean alone and the desire to give aviation the needed forward impetus and to demonstrate to the public that flying is one of the safest means of transportation.

Flying Boats Start with Passengers for Havana

Two large air liners, the Santa Maria and the Pinta, owned by the Aeromarine West Indies Airways, Inc., each carrying eleven passengers besides the crew, left October 24 from the foot of 86th street and the Hudson River on a 1,500-mile flight to Havana.

These two flying boats, the largest ever used for transportation, fitted like Pullman cars, will form part of the fleet that is to operate between Key West and Havana, where a daily mail and passenger service will be put into effect by the Aeromarine Company.

The pilots in charge of the two air liners are Lieut. John W. Iseman, formerly of the United States Navy, and Capt. T. L. Tibbs, who served with the Royal Air Force in the World War. It is possible to foretell storms at least six hours in advance by means of the wireless carried by the ships.

The type of aircraft used by the Aeromarine Company is similar to the F5-L flying boats which the United States Navy produced during the war for extended anti-submarine patrols. The boats have a span of 104 feet and are fitted with two 400 horse power Liberty engines.

The forward cabin has six big chairs upholstered with leather, each with its individual window. The rear cabin, used as a smoking and writing room, seats five.

Making the trip are Baron Quesada, Cuban Consul; Felipe Taboadi, two newspaper women and officials of the Aeromarine Airways Company. The boats stopped at Newport News last night, leaving early this morning for South Port, N. C.

Eight Big Balloons Start On Long Race

Birmingham, Ala.—With the sky the limit and the United States the goal the international balloon race began from the balloon field, North Birmingham, October 23, eight big balloons, including the Pilot, with representatives of the two daily papers, and the Birmingham Chamber of Commerce balloon, piloted by Roy Donaldson, starting on the trip. There was a mild northwest breeze at the time of the start.

A tremendous crowd was out to witness the race. Under the rules the Pilot will have to descend at noon on Sunday, and after leaving out his passengers will make an effort to ride to his home at Springfield, Ill. C. G. Andrus, aerological expert from the Weather Bureau at Washington, during the day studied the wind maps and predicted the balloons would make toward Cairo, Ill., and thence into the Ohio Valley. The morning was employed in filling the big bags with the by-product coke gas from the Sloss Sheffield Steel & Iron Company. The Pilot started at 4.15, and four to ten minutes later the others started in the following order:

First, French balloon, piloted by Capt. Louis Hirschbauer, with Leo C. Nathan, aide.

Second, United States Army balloon, piloted by Lieut. R. E. Thompson, with Capt. H. E. Weeks, aide; 4.34 p. m.

Third, Belgian balloon Belgica, piloted by Lieut. Ernest De Muyter, with Lieut. Mathieu Labrousse, aide.

Fourth, Italian entry, Audens, piloted by Major J. Valle, with Major D. Leon, aide.

Fifth, American entry, Kansas City II, piloted by H. E. Honeywell of St. Louis, winner of the American national race, with Dr. Jerome Kingsberry, aide.

Sixth, Italian entry, piloted by Major H. Madori, with Lieut. A. Pirazzoli, aide.

Seventh, American entry, Goodyear, piloted by Ralph Upson, present international title holder, with W. T. Van Ormann, aide.

Representatives of the Aero Club of America offered the Gordon Bennett trophy, and other prominent personages interested in ballooning witnessed the start with a number of Government officials. Loving cups and cash prizes are also offered.

The start was under auspicious circumstances.

Telegrams dropped from the air by pilots in the international balloon race are to be used in keeping the Aero Club of America informed of the whereabouts of the contestants. By this arrangement officials of the Aero Club expect to minimize the doubts regarding the whereabouts of the balloons after rising—a troublesome phase of all races.

Persons living in cities and villages over which the balloons drift are requested to fill in the telegrams, giving the exact location of the balloons and the time of their passing and file them to the Aero Club headquarters here.

Annual Meeting of the Aero Club

The annual meeting of the club will be held at the club house, 11 East 38th Street, New York City,, on Monday, November 8th, 1920, at 8:30 o'clock P. M., for the purpose of electing a Board of Govevrnors of the club and of dividing the governors so elected into classes as provided in the by-laws, ,and for the purpose of amending the by-laws of the club in accordance with proposed amendments of the by-laws.

The following nominations for governors have been made pursuant to Section 5, Chapter 2 of the by-laws:

Term expiring November, 1921: William W. Miller, Professor Charles Lane Poor, Henry A. Wise Wood, James A. Blair, Jr., Jeffeffrson DeMont Thompson, W. Redmond Cross.

Term expiring November, 1922: Cortlandt Field Bishop, Benjamin F. Castle, Philip A. Carroll, Caleb S. Bragg, Arthur A. O'Brien, William A. Larned.

Term expiring November, 1923: Douglas Campbell, Maurice G. Cleary, Philip J. Roosevelt, Charles Jerome Edwards, F. Trubee Davison, Charles E. Merrill.

Class B: Louis D. Beaumont, Godfrey L. Cabot, Howard E. Coffin, Benedict Crowell, Rear-Admiral B. A. Fiske, U. S. N., Charles J. Biddle.

In the event of the number of the governors being increased to 27, as provided in the proposed amendments to the by-laws, the following gentlemen are nominated and will be voted upon for governors: Albert Bond Lambert, Geo. M. Myers, Harold F. McCormick.

The end of a parachute jump at the U. S. Army Balloon School, Arcadia, California

The AIRCRAFT TRADE REVIEW

The Skylark Side-by-Side Seater

The Skylark two-passenger, side-by-side seater biplane was given its first test flight on Oct. 14th at Gernerd's Farm, eight miles from Bethlehem, Pa.

The machine is a product of the Great Steel City. Mr. Garrett B. Linderman, the engineer, is a Lehigh graduate and a resident of Bethlehem. He was assisted in its construction by Mr. Ben Schroeder. Mr. Linderman during the war was an ensign, instructing flying on large H-16 navy flying boats at Pensacola, Florida. He being accustomed to large, heavy flying boats operated by a wheel control and powered with 800 horsepower, or two Liberty engines, decided to take advantage of a pilot who has tested numerous small land machines operated by a stick control and powered with small engines of around 40 horsepower. The Skylark being equipped with a 3-cylinder 60 horsepower air cooled Lawrance engine.

The pilot chosen for this test work was Bruce Eytinge of New York City, a former lieutenant instructor in the Royal Air Force and last year as test pilot of the single-seater Ace biplane; this year testing the Pioneer single-seater biplane and the new model Ace a few weeks ago.

The Linderman biplane is of standard design and construction throughout. The spread of the top plane is 28′, including a three-foot overhang. Ailerons on the top plane only. The overall length is 22′ and height 7 feet. Total weight of machine empty is 730 pounds, and on one test a 210-pound passenger, 140-pound pilot, 20 gallons of gasoline and six quarts of oil were carried; climbing to 5,000 feet in 15 minutes.

A New Tail Skid for the Curtiss "Oriole"

The Sierra Aircraft Company of Pasadena, in following its policy of "Flying service with the best and newest of equipment," has had a new type of tail skid and mounting placed on its Curtiss "Oriole."

This tail skid is mounted with its support and swivel bearing outside the fusilage, while the shock absorber cord is attached and remains inside the body. The machine, in test, does not show any decrease in speed due to this external mounting. The body has been reinforced to take this new mounting and properly distribute the load and strains throughout the body shell.

When the shock absorber cord has absorbed a load of eight times the static load and remaining over-load in bad landings is transmitted and evenly distributed to the entire body shell through the skid's vertical support.

The tail skid is free swivel, non-recoil, and is so shaped that through failure of any part such as shock absorber cord, front or rear end of the skid, it will act as a sled runner and will evenly distribute the load to the body shell. In event of the breaking of the shock absorber cord the bottom of the fusilage will not be broken or damaged.

This new tail skid allows the machine to be taxied readily and with each without straining the body. An alloy shoe weighing approximately three pounds is used on this skid and will last during the consumption of one hundred flying hours where short flights are made.

National Safety Council Outlines Aeronautic Program

Preparations have been made on an extensive scale toward making aircraft and aeronautics safe. The executive committee of the National Safety Council called a meeting of manufacturers, insurance men and fliers, which was held in the office of the National Workmen's Compensation Service Bureau, New York. The meeting authorized the selection of a committee of experts to investigate practically every detail that would aid in ascertaining hazards and perfecting plans for their elimination or reduction. On the committee is Otto Praeger, United States Post Office Department; Colonel A. E. Truby, Air Service, United States Army; C. M. Williams, manager, Dayton-Wright Airplane Company; J. A. B. Smith, treasurer, Curtiss Airplane Manufacturing Company; AERIAL AGE, Douglas Wardrop, managing editor; E. Stockton Martin, manager, aircraft department, Home Insurance Company, New York; Dr. Frederick L. Hoffman, chief statistician, Prudential Insurance Company; H. N. Wilson, manager, The Associated Companies, Hartford; Professor Charles Lucks, Columbia University; Dr. J. S. Ames, National Advisory Committee on Aeronautics.

The various committees named and the nature of their duties are as follows:

1. Personnel: To determine the qualifications of pilots and consider the subject of proper training and flying methods. The Aero Club of America will appoint this committee.

2. Aeroplanes and Engines: W. H. Merrill, Underwriters Laboratories, Chicago, chairman.

3. Lighter Than Air Machines: This subject has been placed in the hands of the United States Navy Department, by which a chairman will be appointed.

4. Landing Fields: This will be handled by the Aero Club of America, which has agreed to map every serviceable landing field now on record and appoint subcommittees in all large cities where there is any flying being done. The Club will try to induce city councils to make at least one landing field in each city.

5. Equipment and Instruments: Professor Charles Lucks, Columbia University, chairman. This committee will investigate all instruments used in flying and all radio equipment that would affect aircraft now being operated.

6. Communication and Signals: This is in the hands of the United States Signal Corps, which will select a chairman. Its object will be to further radio experiments. An effort will be made to have all lighthouses along the coasts construct glass tops over the lights so that pilots of aircraft may be guided by a perpendicular ray which they can see, instead of a horizontal ray which is of little use to them.

7. Physical Tests: This committee will seek to make it obligatory upon pilots to take physical tests periodically to determine their fitness. The Surgeon Generals Bureau of the War Department has this in hand.

8. Meteorological Information: The United States Weather Bureau has this in charge. The committee will endeavor to have printed bulletins sent to all commercial and mail fliers advising them of weather conditions. These bulletins are to be sent once a day.

9. Legislation: Lieutenant-Colonel Charles Hickam, Washington, will head this committee. He has done as much as anybody in an effort to put flying under government control. He is preparing a bill for presentation to Congress next December, providing that every pilot undergo severe tests before being licensed. The rules to be worked by are the International Air Regulations.

10. Statistics: E. Stockton Martin, Home Insurance Company, chairman. All statistics available will be obtained from insurance companies, aero clubs, the United States Army, and the mail service, besides any that may be in the hands of outside parties.

E. Stockton Martin, manager, aircraft department, Home Insurance Company, will give particular attention to fire hazards, in the study of which his company will take a prominent part. Life hazards will be made a special point by Dr. Frederick L. Hoffman, chief statistician of the Prudential Insurance Company of America and casualty and compensation matters will be in the hands of H. N. Wilson, manager of The Associated Companies, Hartford.

Perfects An Aeroplane With Speed Control

Paris, Oct. 24.—An aeroplane, of which the speed can be varied at the will of the aviator at between 60 and 200 kilometers an hour (25 to 125 miles), has just been invented by MM. Lanvasseur and Gastamvide. The machine is a biplane, so constructed that the surface of the upper plane may be extended or restricted from thirty to fifty cubic feet. In this way the speed is lessened. By the slightest touch of the lever, the surface of the plane expands or contracts. The tests of the new aeroplane have been successful, and experts believe that it will have an important bearing on future aviation.

No Speed Tests Made on Verville Packard

The statement has been made that tests of the VOP-Racer at McCook Field prior to shipment to France for the Gordon Bennett Race, showed that the aeroplane developed a speed of 190 miles an hour, and that this speed has been checked and verified by the engineers at McCook Field. This statement is an error, as no speed tests were made on the aeroplane. The figure of 190 miles having been obtained solely by very approximate mathematical computations.

THE WATERMAN TYPE 3-L400 AEROPLANE

The Waterman Type 3-L400 Aeroplane

THE latest product of the aeroplane manufacturers of Southern California is the Waterman three place aeroplane recently completed and tested at Venice by the Waterman Aircraft Manufacturing Company, a description and general specifications of which appear below.

General Specifications

Motor	400 H.P. Liberty
Weight, empty	2800 lbs.
Weight, loaded	4135 lbs.
Useful load	1335 lbs.
Speed, Max.	126 M.P.H.
Speed, Landing	45 M.P.H.
Speed, Cruising	95 M.P.H.
Climb	10,000 ft. in 8 min.
Ceiling, pilot only	30,000 ft.
Ceiling, one-passenger	25,000 ft.
Ceiling, two-passenger	22,000 ft.
Loading per sq. ft.	8.9 lbs.
Loading per H.P.	10.3 lbs.
Spread, upper and lower	43 ft. 6 in.
Chord	5 ft. 6 in.
Total lifting area	475 sq. ft.
Wing curve	R.A.F. 15
Gap	5 ft. 1 in.
Stagger	26 in.
Dihedral	none
Sweep back	none
Range, full speed	500 miles
Range, cruising speed	600 miles

Areas

Ailerons, 4	60 sq. ft.
Elevators, 2	28 sq. ft.
Hor. Stabilizer	18 sq. ft.
Fin	5 sq. ft.
Rudder	13 sq. ft.

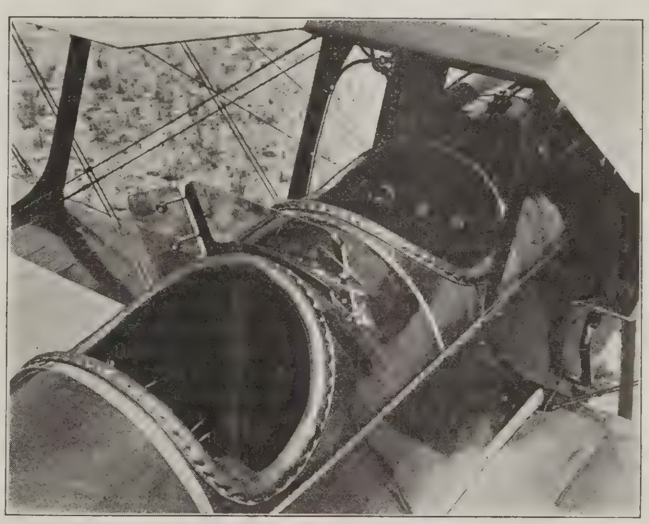
Weights

Fuselage complete with seats, tanks, controls, instruments and accessories	700 lbs.
Motor complete with ignition battery and prop	880 lbs.
Radiators	125 lbs.
12 gal. water	75 lbs.
Tail surfaces	90 lbs.
Self starter and battery	85 lbs.
Landing gear	135 lbs.
Wings, struts, ailerons, fittings and wires	710 lbs.
Total weight empty	2800 lbs.

Throughout the design of the machine closely resembles the well-known Army type Le Pere, but in detail, general arrangement and wing area there is considerable variation to meet civil requirements. This machine has been designed to particularly meet the requirements of high speed, long range, high rate of climb, low landing speed, all combined with a high factor of safety and luxurious appointment. Unofficial tests have already indicated the performance given above to be accurate in every respect.

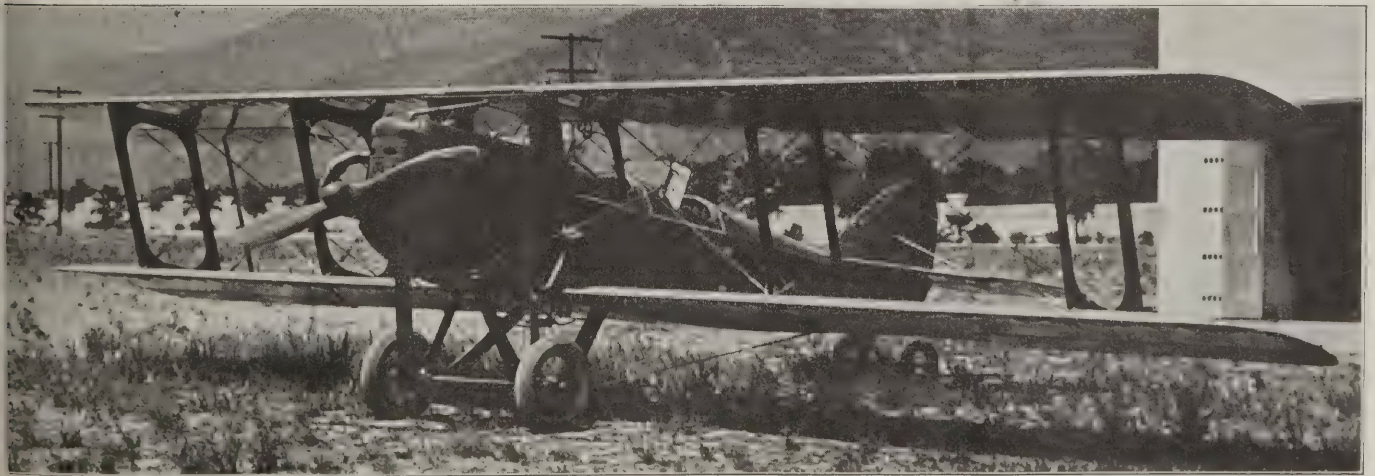
Fuselage

The fuselage is of the rectangular veneer type with bulkheads and longerons. There are four longerons, ash in front spliced to spruce in the rear. These are attached to five bulkheads of eleven-ply poplar and birch veneer. The bottom and sides of the fuselage are covered with mahogany and poplar veneer which is five ply in front and three ply in the rear. This covering acts not only as the tieing member between the longerons and the bulkheads, but as the chief load-carrying member of the fuselage construction. The verticle force is also transmitted through diagonal spruce members from upper to lower longerons between bulkheads. As the covering veneer is in one sheet, it was necessary to construct a large press to make these panels. All veneer work in the machine is special stock, using casine glue. The veneer is fastened to the longerons and bulkheads with casine glue and brass nails and screws. The center section struts are of the picture frame type and are built into the fuselage. They extend to the bottom longeron and completely surround the ends of the lower wing beams. All the cowling is of three-ply mahogany veneer with one ply of muslin.



Cockpits of the Waterman Aeroplane

The motor is mounted on ash sills which rest on two bulkheads and protrude through the rear one and act as a mounting for the main gas tank. The motor cockpit is completely encased in an aluminium fire pan, with suitable drains. Aluminium cowling completely covers the motor. Side type radiators are used. They are set at an angle of twenty-seven degrees to the verticle and are provided with shutters which



Three-quarter front view of the Waterman Biplane can completely cut off the flow of air. The top tanks of the radiators are set into the nose of the upper wing, and conform to its shape. Twelve gallons of water are carried in the whole cooling system.

Wings

In construction the wings do not vary greatly from conventional practice. The beams are spruce of the customary "I" section. All webs are of ⅛" three-ply mahogany and poplar with ash capstrips. The rig spacing varies from 9½" to 10½". There are four compression struts to each wing. All internal wiring is double, 3/16" tie rods being used. Three-ply mahogany veneer covers the nose. No stringers have been used, but in their place four rows of cotton tape wrapped three times around the web and capstrip and then from one rib to the next from top to bottom and vice versa. The covering is of Grade "A" linen with the rib sewing reinforced with selvage tape. Seven coats of dope and three of varnish cover all surfaces.

Both interplane and centersection struts are of the picture frame type built up of five plys of spruce. At the corners, the direction of grain of the second and fourth plys is 45° to the verticle. The direction of grain at all other places is parallel to the member itself. This construction entirely eliminates all stagger or incidence wires. Eight brackets bolted to the strut attach it to the beam through bolts completely clamping the beam. The conventional system of wiring is used. Every wire in the machine is double with the exception of the four drift wires.

Landing Gear

The under carriage does not differ widely from the types used on heavier machines. There are three struts on each side of seven-ply laminated spruce. Each set is made up as a unit with the second, fourth and sixth plys having a cross grain at the bottom. Tubular shock absorber carriers are mounted on the struts and axle parallel to the direction of flight. At the lower rear portion of the struts there is a steel band connecting the two struts. To each end of this are fastened four wires which lead to the lower intermediate strut stations. This forms a very rigid truss, the wires at various times taking lift, landing and drift stresses. A 2¼" axle and 800 mm. x 150 mm. tires and wheels are used.

Ailerons

A rather unique system of aileron control is used. The ailerons themselves are built entirely of steel tube. The beam is 1¾" x 18 ga and the ribs ½" 20 ga, while the trailing edge is ⅜" 16 ga. The whole is hinged on three 1¾" x 2" bearings. The beam of the lower aileron is connected to a 1¾" tube by a dog joint at its butt. This tube runs parallel to the wing beam to the center of the fuselage through two bearings. To the iner end of the tube a twenty-four tooth bevel gear is attached by means of a taper and key. This gear in turn engages with a twenty-tooth bevel gear mounted in a similar manner to the end of the stick control shaft. Naturally the weight of each pair of ailerons balance each other and the result is a smooth, light-running, fool-proof control. The upper alerons are attached to the lowers by an adjustable push and pull rod.

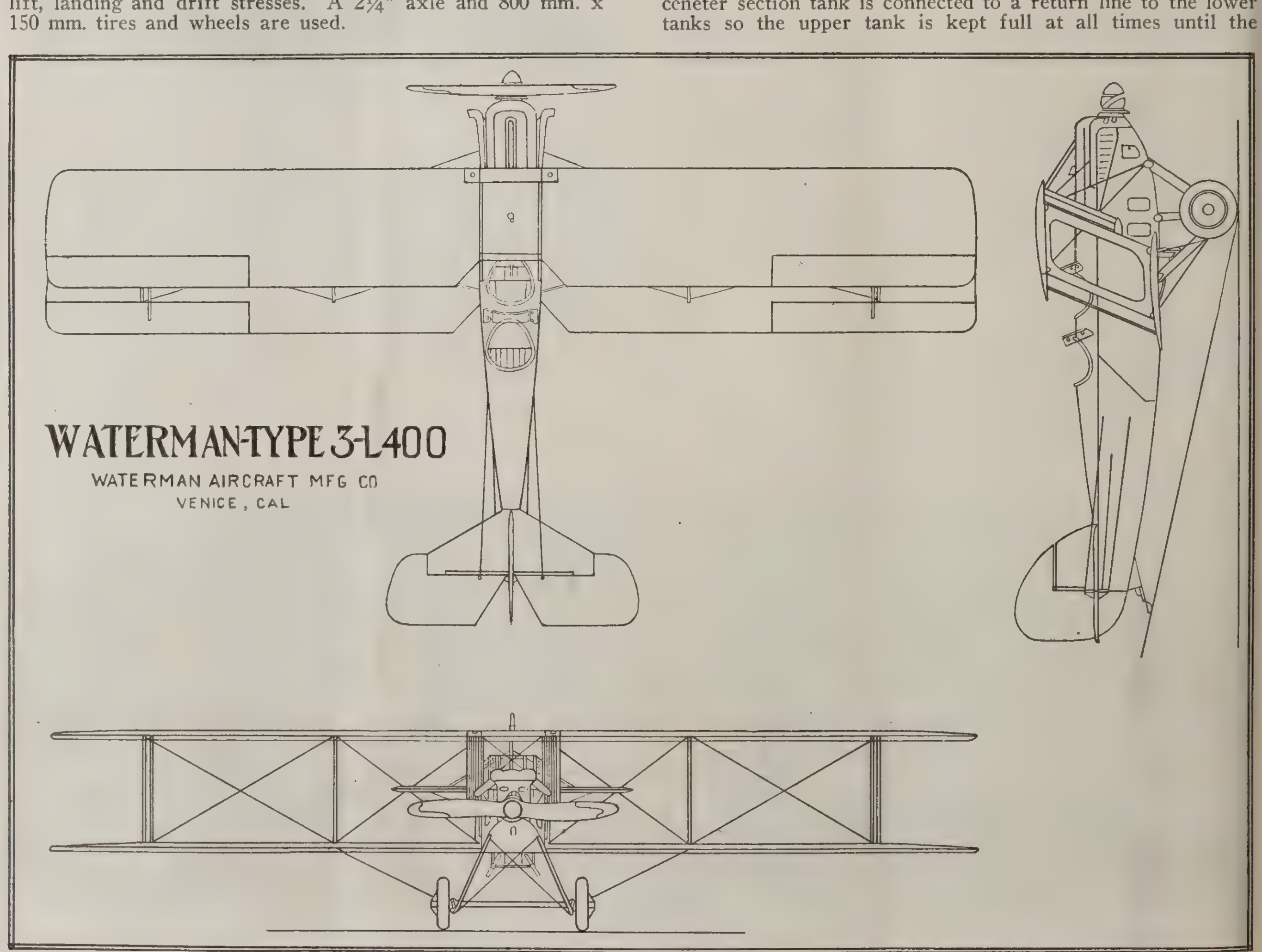
Tail Surfaces and Skid

All of the tail surfaces are of steel tube of similar size and mounting to the ailerons. The control of the rudder and elevators is by the customary horn and wire method. Both of these units are well balanced and work very lightly. The stabilizer is adjustable and of the neutral lift type. It is hinged from the rear with the front attached to a shaft upon which is cut a course thread. This engages with the thread on a bronze drum which in turn is connected with a hand wheel in the pilot's cockpit.

A large metal housing bolted to the lower longerons at the tail post carries the skid. It merely consists of a three-leaf spring secured to the housing and having a suitable shoe bolted to the tip of the lower leaf.

Gasoline System

Gasoline is supplied to the motor by gravity from the twenty-gallon center section tank through two ⅜" lines which are provided with a strainer and dirt trap. There are three tanks in the fuselage, one carrying 65 gallons and the other two twenty gallons each. Two gear pumps driven by air screws mounted below the fuselage pump the fuel from the lower tanks to the upper continuously. A standpipe in the ceneter section tank is connected to a return line to the lower tanks so the upper tank is kept full at all times until the



supply is exhausted in the lower tanks. A sight gauge is connected to the return line showing the proper functioning of the pumps. Either pump will more than supply the motor. The system is so arranged that either or both pumps may draw from any or all tanks. Likewise the return can be directed to any tank. The absence of air pressure and its accompanying danger of fire and trouble is certainly a great advantage.

The oil is carried in two tanks with a total capacity of nineteen gallons, mounted directly under the motor.

Instruments

In the pilot's cockpit there are mounted the following instruments: Altimeter, tachometer, air speed indicator, clock, compass, oil pressure gauge, thermometer, gas return gauge and three gasoline gauges. The passengers' cockpit in the rear is equipped with an altimeter, clock and air speed indicator.

Finish and Equipment

Since the fuselage covering is of mahogany, the whole machine is finished to match. All wooden parts, whether mahogany or not, are of mahogany piano finish. Fifteen coats of stains, fillers and varnishes are on all exposed wood parts. All were rubbed down between each coat. All metal parts are nickel plated and polished. The cloth work is left natural. The pilot's seat is wicker with a deep spring cushion. The passengers' cockpit seats two people side by side. It is completely sealed in with mahogany and is luxuriously upholstered in French plush. A cellarette and locker are provided in the dash and a large luggage carrier under the front seat. A plush carpet is fastened to the floor. Both pilot and passengers are provided with laminated glass windshields with adjustable wings. These are so effective that a passenger can fly in ordinary clothes without goggles or helmet with perfect comfort. The pilot and mechanics also enjoy the luxury of an electric self starter and a dash primer.

As yet there has been no record of a machine quite as elaborate with as good a performance as this one in this country. Let us hope that as time goes on that there will be a real demand for machines of this type and that those that can afford to travel in this rapid and safe as well as enjoyable manner will come to see the real advantages of machines of this order.

BIJUR AUTOMATIC STARTER

AMONG the refinements to aeronautical power plants which have been originated and developed by American genius, is the electric starter which enables the engines of an airplane or "blimp" to be started as readily as an automobile motor. After a number of years of research and development in this field, the Bijur Motor Appliance Company of Hoboken, N. J., has placed on the market an electric starter which has a number of unique and noteworthy features. This unit differs considerably in design from aeronautic starters hitherto manufacured by the Bijur Company. The principle of a starter pinion, which automatically engages with the rotating parts of the engine, during the time of starting only, is retained. The exposed propeller hub gear ring is eliminated, however, and the whole mechanism is contained in one compact, fully-enclosed unit, which is bolted directly to a crankcase flange at the non-driving end of the crankshaft, where it adds only five inches to the total length of the power plant.

As shown in the accompanying illustrations, this new unit is attached by being merely bolted to the crankcase at the end of the crankshaft opposite to the propeller. Designed particularly to meet the requirements of the Liberty Twelve, this starter is adapted for use on a number of other leading engines. Provision for its attachment permit its being readily mounted on such aeronautical power plants as the Curtiss C-12, Packard, Thomas-Morse and other engines. Although manufactured with only one type of mounting flange, this starter may be had in either clockwise or anti-clockwise rotations, and for mounting with the electric motor located vertically either above or below the crankshaft center line.

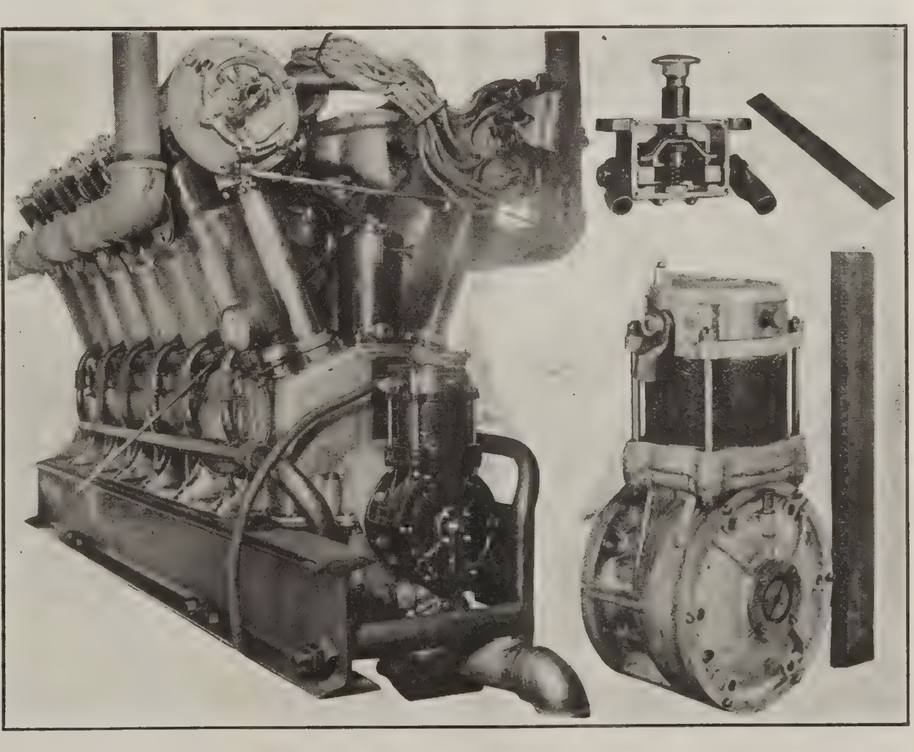
The features of this starter particularly emphasized are performance, safety devices, light weight, compactness and ease and certainty of installation. The source of power is a 4" diameter, 12-volt series electric motor which cranks the engine through a bevel gear and planetary reduction of 115 to 1 on the crankshaft. On the Liberty Twelve, the cranking speed is 40 to 50 r.p.m., with a current consumption of 110 to 150 amperes, varying according to the stiffness of the engine and the condition of the battery.

The well-known Bijur automatic shifting mechanism is employed, and the starter is connected to the crankshaft during the time of starting only. When the starting switch is depressed, permitting current to flow from battery to starter, the splined starter screw shaft moves longitudinally into mesh with splines cut internally in the hollow end of the crankshaft. This disengages automatically as soon as the engine begins firing.

Special provision is made to disengage the starter pinion in case of a backfire while cranking without damage to either starter or engine. By applying a wrench, brace or crank handle to the nut protruding from the back of the starter housing, the apparatus becomes a hand starter with a reduction of 20 to 1, with both automatic engagement and safety devices functioning.

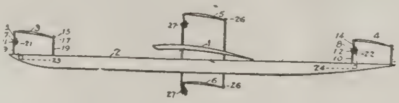
Special attention has been given to obtaining minimum weight and small size without sacrifice of strength or performance. The mechanism weighs slightly less than 30 lbs. and adds only 5 inches to the length of the engine when installed.

Being mounted on the engine crankcase by means of a flanged mount, which is held by five studs, no shimming or adjusting is necessary. This insures that when once installed the starter will "stay put," eliminating all possibility of misalignment trouble. Being fully enclosed, the unit is not affected by oil, water or dirt.



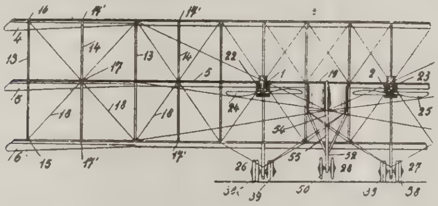
RECENT AREO PATENTS

1,307,133. AEROPLANE. Christopher J. Lake, Bridgeport, Conn. Filed Aug. 14, 1917. Serial No. 186,149. 8 Claims. (Cl. 244—29.)



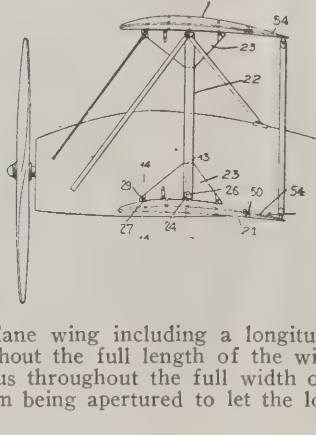
1. In an aeroplane, an auxiliary aerofoil presenting, for support, a normal angle of incidence in the line of flight, said aerofoil turnable about a fixed lengthwise axis in the central vertical plane of, and so inclined forwardly downward to the longitudinal axis of the aeroplane, that said aerofoil, for control, presents varying angles of incidence to said longitudinal axis.

1,325,230. FLYING MACHINE. Federico Caproni, Milan, Italy. Filed July 24, 1916. Serial No. 110,850. 2 Claims. (Cl. 244—14.)



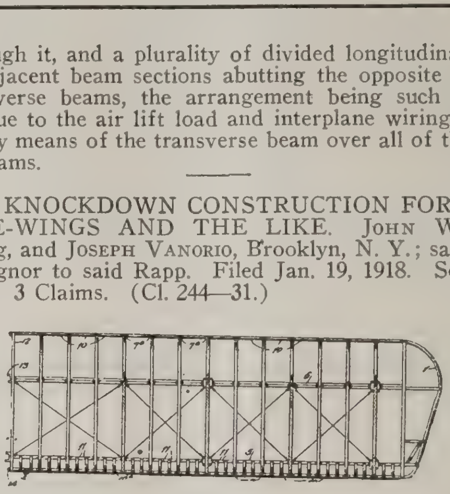
1. A multiplane flying machine comprising in combination two fuselages symmetrically arranged with respect to the center line of the apparatus, two motors arranged on the forward ends of said fuselages, propellers attached to said motors, a tail plane and a horizontal rudder mounted at the rear end of said fuselages, three vertical rudders rotatably mounted at the rear end of said fuselages and means to rotate said vertical rudders simultaneously; a front body consisting of three planes arranged one above the other and wherein the angle of incidence of the upper plane is smaller than that of the lower plane and the middle plane has an angle of incidence comprised between those of the others, two series of uprights for securing the said arrangement of the planes arranged in two rows respectively on the front and on the rear of the said forward body, the first row of uprights having their ends fixed respectively to the forward longitudinal frames of the upper and lower plane and their center attached to the middle plane, the second row of uprights having one end connected to the rear longitudinal frames of the central plane and having the other ends connected to the longitudinal frames of the upper and lower planes, diagonal members consisting of stay wires, metallic cross pieces for fixing stay wires so that they adjoin the ends of said uprights, a car mounted through the front body and comprising the aviator seat, the control devices, and rearward, a third motor on said car driving a propeller.

1,310,942. AEROPLANE-WING CONSTRUCTION. Nelson W. Dalton, Garden City, N. Y., assignor to Curtiss Aeroplane and Motor Corporation, a Corporation of New York. Filed March 25, 1918. Serial No. 224,547. 7 Claims. (Cl. 244—31.)



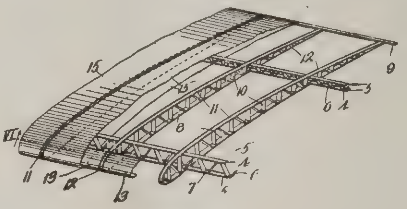
1. An aeroplane wing including a longitudinal beam continuous throughout the full length of the wing, a transverse beam continuous throughout the full width of the wing, said transverse beam being apertured to let the longitudinal beam pass through it, and a plurality of divided longitudinal beams having adjacent beam sections abutting the opposite faces of the transverse beams, the arrangement being such that the stresses due to the air lift load and interplane wiring are distributed by means of the transverse beam over all of the longitudinal beams.

1,325,499. KNOCKDOWN CONSTRUCTION FOR AEROPLANE-WINGS AND THE LIKE. John W. Rapp, Flushing, and Joseph Vanorio, Brooklyn, N. Y.; said Vanorio assignor to said Rapp. Filed Jan. 19, 1918. Serial No. 212,784. 3 Claims. (Cl. 244—31.)



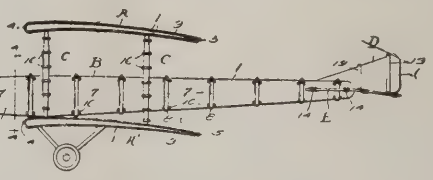
1. A knockdown wing construction for aeroplanes embodying parallel marginal frame members, rib units having ferrules at opposite ends of the same conformation as said frame members and adapted to slidingly fit over said frame members, means for spacing said rib ferrules and means for securing the ribs, spacing means and frame members together.

1,337,951. AEROPLANE-WING CONSTRUCTION. Francis J. Plym, Niles, Mich., assignor to Kawneer Manufacturing Company, Niles, Mich., a Corporation of Michigan. Filed Oct. 11, 1918. Serial No. 257,781. 3 Claims. (Cl. 244—31.)



2. In an aeroplane, a wing comprising intersecting beams and ribs, a trailing edge strip connecting the rear ends of said vided with flanges adjacent the ribs, strips fitting around the ribs and provided with side channels receiving the flanges of the nose plates, cover sections between said strips and around said nose plates and fitting in the channels of the strips, and means securing the side edges of the cover sections within said channels.

1,297,882. ATTACHMENT FOR AIRCRAFT TO RENDER SAME INVISIBLE. William D. McCormack, Nashville, Tenn. Filed Aug. 20, 1917. Serial No. 187,303. 5 Claims. (Cl. 244—31.)



1. A sheathing for aircraft comprising a series of strips of flexible translucent material colored to suit weather conditions, with means for detachably connecting said sheathing to the aircraft, substantially as and for the purpose described.

4. A sheathing for aircraft comprising a series of strips of flexible translucent material colored to suit weather conditions, each strip being provided with a silvered backing adjacent to the part of the aircraft to be screened, with a series of metal straps hinged together in pairs for detachably connecting said sheathing to the aircraft, substantially as and for the purpose described.

5. An aeroplane having the wings, rudders and part of the body portion thereof made of transparent material and the stanchions and remainder of the body portion sheathed with strips of flexible translucent material colored to suit weather conditions, substantially as described.

NAVAL and MILITARY AERONAUTICS

Flight From Barron Field to Kelly Field

During this week Lieut. Henry E. Wooldridge and Paul H. Prentiss, flying a DeHaviland 4D, flew from Barron Field to Kelly Field, San Antonio, in an hour and forty-five minutes; this is the fastest time ever reported between these two points.

Cadet Training

The training of cadets continues apace. Some of the men take the Pursuit Course and some take the Bombardment Course. The schedule that has been laid down for the cadets taking the Bombardment course is as follows:

First Week:

No flying. Class instruction only.

Morning.

1. Radio, 8-9:45.
2. Photography, 10-10:45.
3. D. R. Signaling, 11-12:00.

Afternoon.

1. Theory of Radio.
2. Study of sets and their installation.
3. In Planes. This to include both Telephones and Telegraph.

Second Week:

Morning.

Flying, 8:30-11:30.
Radio, 7 hours.
D. R. Signals, 1 hour.
Photograph, 2 hours.

Afternoon.

Radio, 1:00-2:00 p. m.
Bombing, 2:10-3:00 p. m.
Infantry Contact and Message Dropping, 2 hours.
Theory.
History.
Bomb Sights.
Formations.

Third Week:

Morning.

Flying, 8:30-11:00.
Photography, 2 hours.
D. R. Signals and Message Dropping, 2 hours.
Accuracy, 1 hour.

Afternoon.

Radio, 1:00-2:00 p. m.
Gunnery, 2:10-3:10 p. m.
Reconnaissance, 3:20-4:30 p. m.

Fourth Week:

Morning.

Flying, 8:30-11:30.
Infantry Contact, 2 hours.
Camera Obscura, 3 hours.

Afternoon.

Monday, Wednesday and Friday.
Radio, 1:00-2:00 p. m.
Artillery Adjustment, 2:10-4:20 p. m.
Tuesday and Thursday.

Fifth Week:

Morning.

Flying, 8:30-11:30.
Photograph (aerial), 3 hours.
Camera Guns, 2 hours.

Afternoon.

Artillery Adjustment, 1:00-2:00 p. m.
Uses and Kind of Aviation, History of Development.
Possible Development, 2:10-3:20.
Miniature Range, 3:20-4:30.

Foreign Aviation Instruments

Several new instruments, most of them of German manufacture, have been received from the Bureau of Standards' representative in Europe, and have been studied carefully with the object of obtaining information concerning the future design of aeronautic instruments in this country. A Bamberg distant compass (a German instrument) has been thoroughly investigated and some very interesting results have been obtained. This compass depends for its operation upon the characteristic of selenium, which causes a variation in its electrical resistance with any change in the intensity of illumination falling upon it. The installation is so arranged that the compass itself may be mounted in the tail of the airplane at a distance from all disturbing magnetic influences. The bowl of the compass contains two electric bulbs diametrically opposed which throw their rays through a lens which concentrates them upon two corresponding selenium cells mounted on a bridge extending across the top of the bowl. A metal disk, corresponding to the card of the ordinary compass, is cut in such shape that it acts as a blind for the illuminating elements. Thus the intensity of lighting of the selenium cells is varied in accordance with the position of the magnetic element carrying this disk. By means of a properly arranged electric circuit, the position of the magnetic element is made known to the pilot by the indications of an ammeter suitably calibrated and mounted on the instrument board. The navigator is able to direct the pilot on a desired course by means of an indicator connected mechanically to the compass in such a manner as to make possible the rotation of the bowl at will by the navigator.

The Bureau has spent considerable time in making a comprehensive index and list of material forwarded to this country by a member of the Aeronautic Instruments Section who was for some time in Europe. The object of the index is to render the material on hand more accessible and useful to interested persons outside the Bureau.

Flying Time at March Field for One Week

Here's "atmospheric" proof of the assertion that California is the best place in the United States to fly. At March Field, Riverside, Calif., during the week of September 20, 760 flights were made. Seventy-one ships were used and a total of 790 hours and 55 minutes consumed, approximate distance covered being 52,415 miles.

Preliminary instruction of flying cadets consumed 479 hours and 50 minutes; miscellaneous flights, 75 hours and 25 minutes, and test flights, 6 hours and 50 minutes.

Army Airship Zodiac Flies Over Washington

The Army airship Zodiac (Z.B.U.S.-1) flew from Langley Field to Washington, D. C., on Oct. 11 for the purpose of taking motion pictures from the air. The trip, which was aided by the wind, was made in a little over two hours. Capt. Dale Mabry, of the Army Air Service, was in command of the Zodiac, with Lieut. George W. McIntyre, Lieut. F. Claire and a full crew of enlisted men. After flying over the city the airship started back without landing to Langley Field.

Non-Flying Officers in Air Service

Major Gen. Charles T. Menoher, Chief of Air Service, U. S. A., and his staff are putting into effect the proviso of Section 13a, act of June 4, 1920, which concerns the commissioned flying personnel of the Air Service. This reads: "That not to exceed ten per centum of the officers in each grade below that of brigadier general who fail to qualify as aircraft pilots or as observers within one year after date of detail or assignment shall be permitted to remain detailed or assigned to the Air Service." Among the officers now qualifying for permanent duty with the Air Service are Majors Oscar Westover, U. S. A., and William F. Pearson, U. S. A.

U. S. Z. D. No. 1 Visits Washington

On October 12, about the hour of 2 p. m., an unusual buzzing and humming was heard in the air, and presently spectators saw the largest airship in America, the great U. S. Z. D. No. 1 sailing over Washington city. The ship had made the flight from Langley Field, Va., a distance of 159 miles in 2 hours, the occasion having been arranged by the Army Air Service for the purpose of having a series of moving pictures taken from the giant dirigible while in flight, the first attempt of its kind in America. In reality, there were three series of pictures being shot, one being made at Langley of the Z. D. No. 1 taken from another ship; another, a series of the terrain taken from the Z. D. No. 1 itself, and a third being a series of shadow pictures shot from the big ship and showing the shadows made by itself in flying. These pictures, which will appear in the weekly news, will be of unusual interest.

The ship was in command of Capt. Dale Mabry, with Lieuts. Wilfred M. Clare and Geo. W. McEntire, and a crew of five enlisted men.

The Z. D. No. 1 is a non-rigid airship with a gas capacity of 328,000 cubic feet and a cruising distance of 902 miles. Its maximum speed is 60 miles per hour. The two engines are of the Renault Vee type, of 220 horse power each. The big ship has a length of 260 feet, height 49 and six-tenths, width 38½ feet, with a carrying capacity of 25 passengers.

From Langley Field comes the report that the big dirigible, under the command of Captain Mabry, made a trip to Richmond where they maneuvered over the State Fair Grounds. Moving pictures of the complete trip were made by the Langley Field Photo Detachment, over 4,000 feet of film being exposed. During the trip a very high wind arose, but the return to the field was made without accident and the big ship was successfully landed and stowed away in her hangar. During the whole trip the ship was in constant communication with Langley Field by radio.

FOREIGN NEWS

Berlin-Vienna Air Service

The latest air service to be started is one between Berlin and Vienna. There are alternative routes via Muremberg and Munich. The Vienna Society for Aerial Traffic is organising the service in conjunction with an international air pool, and it is proposed to open connection with Italy and the Balkans. The fare for the journey between the two capitals is 2,500 marks.

Competition for "Sport 'Planes"

In July last a meeting, organised by the "Lega Aerea Nazionale," took place in Italy for small sport 'planes, but the results were not very satisfactory from a practical point of view. Now Sr. Mapelli, whose part in Italy may be compared to that of Mr. E. Archdeacon or Deutsch de la Meurthe in France, has decided to offer the Mapelli Trophy in an international contest.

The trophy is a work of art representing the continents of the world surrounding a block at the top of which is an aeroplane. The first prize is 3,000 Italian lires, and the second is fixed at 2,000 Italian lires. Several gold medals and works of art of less value will reward the other classified competitors.

Swedish Air Mail Stamps

A *Daily Telegraph* correspondent states that the first air mail stamps of Sweden were issued on September 19, on the same date that the air line connecting Malmö-Copenhagen-Hamburg-Amsterdam-London started. The Swedish post office accepts letters and postcards for transit by air mail provided that they are prepaid with the ordinary postage, and (if required) registration fee, plus the following rates for air transit:

	Letters and Printed matter Weight 20gr. öre	Post cards öre
To Germany, Switzerland, and other countries in Europe not specified below	20	10
To Holland, Belgium, France, Spain, and Portugal	40	20
To England, U. S. A., and countries which are mailed via England	60	30

The stamps issued are provisional ones, consisting of the current types of official stamps of Sweden overprinted "Luftpost" (Air Post) and surcharged with new values:

10 öre on 3 öre, brown
20 öre on 2 öre, orange
50 öre on 4 öre, lilac

It is not improbable that other values may be issued, as at present it takes all three stamps to pay the rate to England, 20-öre postage, plus 50 öre air post fee.

Circular Re Aviation Insurance

In an effort to interest the various insurance companies operating in Canada to accept aviation insurance, both as regards personnel and machines, about 100 firms have recently been circularized with a letter over the signature of the secretary pointing out the importance of this class of insurance in the development of commercial aviation in this country. Appended to this letter was an extract from the last report of the Controller-General, Civil Aviation in Great Britain, indicating the relatively small number of accidents which have occurred in proportion to the number of hours flown by civil aircraft in Great Britain, over a period of six months.

British Competition Awards

The British Air Ministry announces:

The Judges' Committee consider that the results of the Competitions for aeroplanes show collectively less radical advance in general design than had been anticipated, and that though very useful developments in detail design have been produced, which in themselves have justified the Competitions, the award of the full prizes originally specified is not warranted. The following sums have therefore been awarded:

(a) *Large aeroplane class*	
First Prize	Not awarded
Second Prize—Messrs. Handley-Page Transport Ltd., *H.P. W.* 8. fitted with 2,450 h.p. Napier "Lion" engines	£8,000
Third Price—Messrs. Vickers Limited, Vickers Vimy Commercial, fitted with 2,350 h.p. Rolls-Royce "Eagle 8" engines	£4,000
(b) *Small aeroplane class*	
First Prize—*Messrs. Westland Aircraft Works, Westland* "6-seater", fitted with 450 h.p. Napier "Lion" engine	£7,500
Second Prize—Messrs. Sopwith Aviation & Engineering Co., Ltd. Sopwith "Antelope" fitted with 180 h.p. Wolseley Hispano "Viper" engine	£3,000
Third Price—Messrs. Austin Motor Co., Ltd., Austin "Kestrel" fitted with 160 h.p. Beardmore engine	£1,500

A further announcement will shortly be made regarding the results of the Competition for Seaplanes (Amphibians), followed in due course by a full technical report upon the whole of the Competitions.

Chile's Enthusiasm for Aviation

Reports from Valparaiso are to the effect that Chileans have not been slow to recognize the importance of aircraft, both in regard to national defence and for commercial purposes. Months ago the Chilean Ladies Patriotic Committee set a movement on foot throughout the country for the purpose of purchasing aeroplanes by public subscription. This has been taken up with enthusiasm and there is keen rivalry between the provinces as to which will succeed in raising the most money for the purpose. Many thousands of dollars have already been subscribed and the ladies have now handed over the organization to an official Committee, comprising the Director General of the Navy, the Ecclesiastical Governor and other highly placed officials, who are developing the movement in the national interests.

German Aviation Progress

It is reported that the North German Lloyd Company has succeeded in forming a combine of the leading aviation companies in Germany, Austria and Denmark. The Companies interested are the Albatros G.M.B.H. of Berlin, the Badische Luftverkehrsgesellschaft of Baden, the Bayrischen Rumplerwerke A.G. of Augsburg and Berlin, the Dansk Luftekpress of Copenhagen, the Hannoverische Waggonfabrik of Hanover, Wollers Flugzeugwerke of Dessau, the Lloyd-Luftdienst G.M.B.H. of Bremen, the Sablatnig Flugzeugbau, G.M.B.H. of Berlin, and the Wiener Flugverkehrsgesellschaft of Vienna. The German combine owns a number of commercial aeroplanes with saloon accommodation, capable of carrying from four to eight passengers and mails. Electrically-heated foot warmers have also been fitted for the comfort of travellers during the winter season. The service between Vienna and Berlin is via Nuremberg and Munich, as German aviation companies, at present, are not permitted to fly over Czecko-Slovak territory, but many connections have been decided upon in order to link up Northern Germany with Switzerland, Austria, and Constantinople, and also with a view to coupling up with the International air ilnes in the West. The rate fixed by the new combine for passengers between Vienna and Berlin is 2500 marks single, which is about three times as much as is charged at present for a first class railway ticket including sleeping car charges. The time taken by rail is 26 hours as compared with 4 hours, 50 minutes by the new air route. The following are the details published in connection with the new air services.

Berlin-Amsterdam, 375 miles, 4 hours.
Amsterdam-London, 2½ hours.
Berlin-Copenhagen, 232 miles, 2½ hours.
Vienna-Munich, 219 miles, 2 hours, 10 minutes.
Munich-Berlin, 313 miles, 3 hours, 10 minutes.

Italy is also to be included in the service from Vienna to Milan, via Tarvis, distance 385 miles, flying time 4 hours, 20 minutes. Air services have also been decided upon from Berlin by connections with Vienna-Budapest-Belgrade-Sofiia-Constantinople, and also branch lines to cover the whole of Italy.

A Remarkable Business Journey

As showing the enormous value of the aeroplane in countries where communications are slow and spasmodic, a business trip recently undertaken by the London manager of the Anglo-South American Bank in visiting the branches of his institution in Uruguay and South Brazil is more than a little interesting. Briefly, he covered a distance of 625 miles in 6 hrs. 5 mins. actual flying time, against an average of 5 days by combined rail and sea routes. The whole business tour was completed in ten days, against over twenty days which would have been expended by taking the alternative modes of conveyance. The figures are eloquent of what the aeroplane is capable of in saving the valuable time of an important official of such a corporation as the bank in question, and we doubt not the progressive London manager, Mr. Kiek, is fully satisfied with the results of what was a pioneer business flight in that part of the world. It is said that the flight has attracted a great deal of attention in Brazil and has vastly improved the local prospects of aviation.

A German-Swiss Convention

A convention regulating aerial traffic between the two countries has recently been completed between Switzerland and Germany. The convention, which is similar in terms to those now in effect between Switzerland and Great Britain and France was signed by M. Motta, the President, on behalf of the Swiss Confederation, and by Herr Muller for Germany.

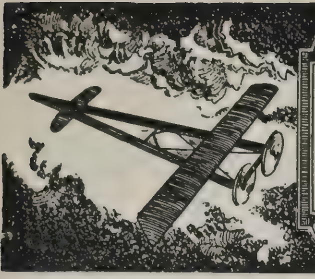
A Royal Gift by Air

It was fitting that the aerial post between England and Copenhagen should be inaugurated on September 30 by Queen Alexandra, who chose this method of sending 5 kilos. (about 11lb.) of fruit in a basket to the Empress Marie of Russia. The basket had been despatched from Marlborough House on the previous day at three o'clock, and was conveyed to the Empress at her country seat, Hvidoere, outside Copenhagen at 5 p.m. on September 30.

Meetings of the Royal Aeronautical Society

The following lectures have been arranged for the coming session:

1920.	LECTURER	SUBJECT
Oct. 7th—	Sir F. H. Sykes, Hon. Fellow	"Civil Aviation." Chairman: The Right Hon. A. H. Illingworth, Postmaster-General.
Oct. 21st—	Sq.-Ldr. R. M. Hill, Associate Fellow	"A Comparison of the Flying Qualities of Single and Twin-engined Aeroplanes."
	Cecil Baker	"Night Flying."
Nov. 4th—	Wing-Comdr. Flack	"The Human Machine in Relation to Flying."
Nov. 18th—	H. B. Irving, Associate Fellow	"The Design of Aeroplane Control Surfaces, with Special Reference to Balancing."
	A. Fage, Fellow	"Air Screws."
Dec. 2nd—		"Airship Mooring."
	Major Scott, A.F.C.	"Airship Piloting."
Dec. 16th—	H. Ricardo	"Possible Developments in Aircraft Engines."
	A. J. Rowledge, Member	"The Installment of Aeroplane Engines."
1921		
Jan. 20th—	Lord Montagu of Beaulieu, Founder Member	"The Cost of Air Ton-Miles Compared with Other Forms of Transport."
Feb. 3rd—	G. Dobson	"Meteorology and Aviation."
	Wing-Comdr. H. W. S. Outram, Associate Fellow	"Ground Engineering."
Feb. 17th—	F. Handley Page, Fellow	"The Handley Page Wing."
Mar. 3rd—	J. W. W. Dyer	"Airship Fabrics."
	Major T. Orde Lees	"Parachutes."
Mar. 17th—	Capt. D. Nicolson, Associate Fellow	"Flying Boat Construction."



ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

INHERENT stability is a problem that aeronautical engineers have tried to overcome since the first flight of the aeroplane, and up to now they have only partly succeeded in making the aeroplane stable.

Inherent stability means that no matter what outside forces act on the machine to throw it into a nose dive or a side slip, it will always come back to its normal position. The Burgess-Dunne, and the old German Taube were machines having inherent stability.

A machine of this type while possessing excellent qualities for sporting or commercial aeroplanes, works just the opposite when used for war purposes, because the fighting aeroplane must be of such design that it will answer readily to the will of the pilot, such as the strategical manœuvres a pilot must make to throw off, or overcome an enemy.

With a machine of the inherently stable type it would be hard to make an Immelman turn, loop, or corkscrew, because while the pilot would use his controls to throw the machine into the position he would choose, the machine itself would try to stay at normal and of course it would be sluggish, and useless for fighting, but as a sporting type or for commercial use this will be the type of machine in the future, as it allows the pilot to rest at times and he would then be able to fly many times the distance he could cover in a machine of the unstable type and without exertion.

By studying the examples shown in the accompanying drawing the reader will clearly see how an aeroplane can be designed to be stable.

Fig. 1 shows a model with wings set at what is known as a dihedral angle, just below the model, a front view of a boat with a "V" bottom is shown, how these two resemble each other in principle is shown at Fig. 2. The boat although thrown over on its side by a wave is still safe because the "V" bottom of the boat now presents a flat surface to the water and the center of gravity will hold it in this position and when the wave drops off it will go back to normal.

The model above is in the same position as the boat, the cross wind, arrow A, is trying to turn the machine over on its side, it does so, until the left wing reaches a horizontal position, then the lift on this wing increases and the lift on the right wing drops off because it is now at an extreme angle and the machine returns to its normal position.

The reader will see that one wing is getting more lift than the other, naturally, the side getting the greatest lift will rise and the one losing lifting power will fall.

In Fig. 3, a machine of the unstable type is shown, and directly below it, a flat bottom boat, how these two resemble each other is shown at Fig 3. The wave lifts the boat over on its side, and having no flat side as in the "V" bottom boat, it is in danger of overturning. This is also the case in the model above it, the wind, arrow A, is lifting the machine over on its side, both wings are getting the same lift so there is no force trying to right the machine and the consequence is the machine starts to side slip and before long gets into the position shown in Fig. 5, and the pilot would have to use his controls to bring the machine back to its original position.

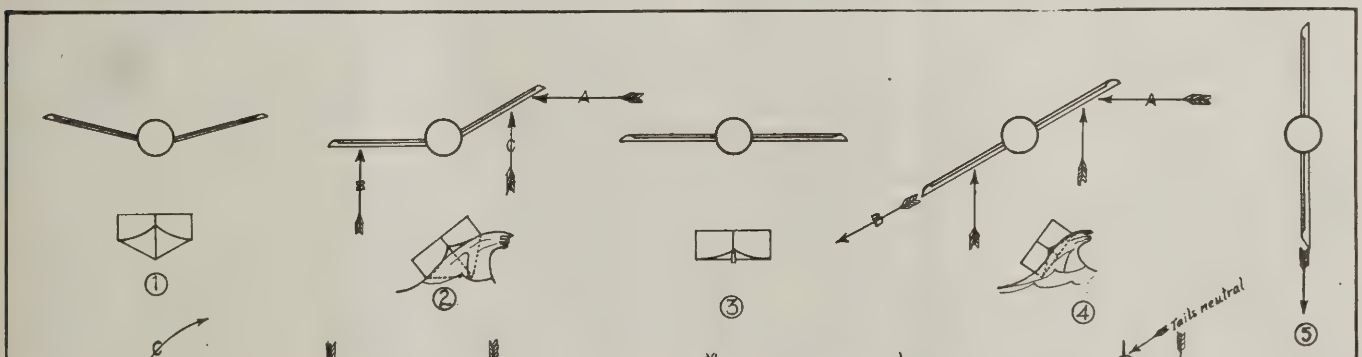
Now this is for lateral stability only. For longitudinal stability it is necessary to have the tail plane set at sort of "V" to the main plane.

Fig. 6 shows a model that is longitudinaly unstable, because it has what is known as a lifting tail, and the machine has two forces to overcome the weight of engine, etc., arrow W and the lift of the tail, arrow B, the result is the tail starts to travel in the direction indicated by arrow C and before long would put the machine in the position shown in Fig. 8. The machine would then nose dive and travel in the direction shown by arrow R, because the lift of the elevator and main plane tends to keep the machine moving to the right and the weight of the machine keeps it moving down and the resultant is indicated by arrow R.

Figure 7 is a model having longitudinal stability because it is so designed that it does not need a lifting tail, instead it has a neutral tail acting somewhat as the feathered end of an arrow. The forces acting on this tail are equal, and the result is the tail remains neutral. Should the machine nose dive as Figure 9, the tail being neutral and the main plane having a lifting force which tends to move the nose to the right, the result is the machine soon arrives at the position in Figure 10, and eventually flattens out to its correct position.

Should the reader have any difficulty in grasping the explanations set forth in this article I would advise making a simple paper glider as shown at the bottom of the drawing. The glider is made from a fairly stiff sheet of ordinary writing paper, then one end is folded about 3 inches as shown. Now fold in half and cut to the shape shown by the dotted line.

When completed the reader should try various experiments such as throwing the glider upside down, spinning it around, or in fact any position at all and the glider will land right side up every time, showing that an aeroplane can be made absolutely stable.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Postponement Welcomed

"Private Blank," said the Colonel severely, reprimanding a doughboy for a minor breach of military regulations, "what would you do if I were to say that you were to be shot at sunrise?"

"Gosh, Colonel," replied the Yank, watching the shadow of a grin steal over his officer's face, "I'd sure pray for a cloudy day."

Not Taking Any

A big, powerful motor slowed up as the occupants perceived a car of very modest proportions standing by the roadside in a rather battered condition. The owner of the car was on his knees, endeavoring to straighten out some of the parts.

"Have an accident?" queried the man in the big car.

"No, thank you," grimly returned the other, "just had one."

Tourist (leaning from the window of train beckons to you): "Boy, does the time change here?"

Boy: "Nope, we use the same all year."

First Bo: "I sure feel tickled today."

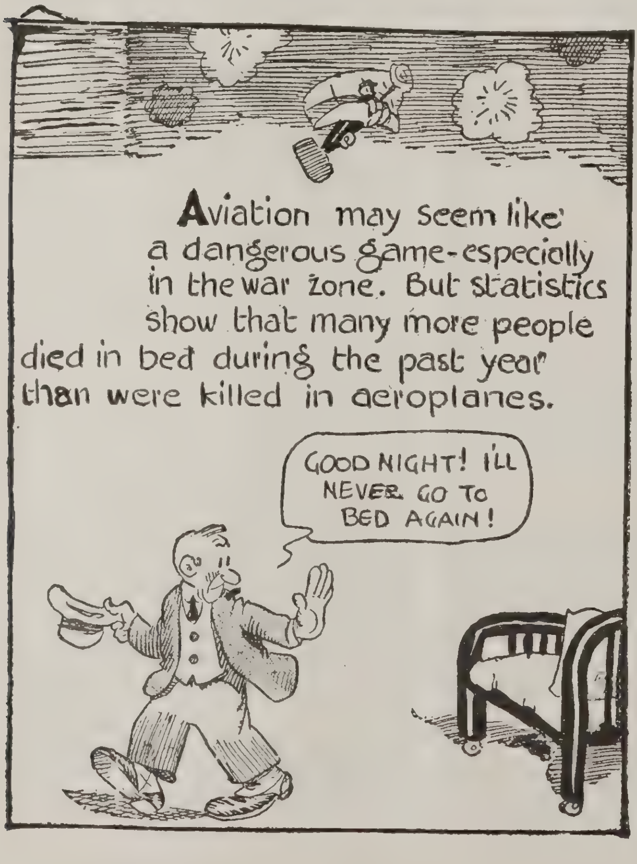
Second Bo: "How's that?"

First Bo: "Mother just sent me my woolen underwear."
—*Puppet.*

Philosophy

We offer the following to prospective aviators who fear injury, as a sort of balm for the mind.

Either you go up into the air or you don't. If you don't go up there is no cause for worry. Now let us consider that you go up. Either your machine is a strong one or it is not. If it is there is no cause for worry. If it is not, you will either fall or you will not. If you do not fall, do not let the matter trouble you. If you do fall, you will either be injured or you will be safe. If you are safe, forget about it. Let us consider that you are injured. You will either die or get well. If you are going to get well you are foolish to worry. If you die you can't worry, so why worry in the first place? Und so weiter ad infinitum.


Aviation may seem like a dangerous game-especially in the war zone. But statistics show that many more people died in bed during the past year than were killed in aeroplanes.
GOOD NIGHT! I'LL NEVER GO TO BED AGAIN!

Reasonless Rhymes

Gustave had an aeroplane,
He flew it for the Kaiser
Until he tried to loop-the-loop,
He's crippled now—but waiser.
(Yes, we meant to spell it that way.)

Tests for Pilots of Reikavieakzz

We are able to give, this week, a résumé of the examination which all aspiring pilots of Reikavieakzz have to undergo before being admitted to the Royal Aeroplane Corps, Submarine Division:

(1)—Name and locate at least six undiscovered islands in the Pacific Ocean.

(2)—Who invented the aeroplane? When? Why? Give reasons.

(3)—How many revolutions a minute in rough figures? Prove your answer.

(4)—How many gallons of gasoline are required to run an eight-cylinder motor which is quite powerful?

(5)—Which is more efficient, an eight-cylinder motor with a four-foot propeller or a four-foot motor with an eight-cylinder propeller? Is this the case with the conditions reversed? Who?

(6)—If on attaining a height of eight thousand three hundred and eighty feet seven and a half inches, it is found that the motor has been left on the ground, what is the correct procedure?

(7)—Give the history of your life. (You may omit embarrassing details.)

(8)—In as many words as possible (one hundred at most), give the history of aviation.

If the pilots pass this test and still retain their sanity, they are put through another ordeal.

They are first hit upon the head with a one-hundred-pound hammer nine times to accustom them to falling from great heights and landing upon their craniums. If they still live after this test the examiners do not give up hope but go at the thing more seriously. While a cake of ice is held against the aspirant's stomach, molten lead is poured into his ears. This is calculated to accustom him to rapid changes in temperature. He is then put to work upon the stock-books of some mining company, which gives him a perfect idea of balance. Then follows the hardest test of all. He is led into a room in which are seated ten cullud gem'men and he is given a quick glance at their faces. If after three days he still can remember them, he is judged an expert in map-reading. Then if he has passed through all these ordeals, and the committee finds it absolutely impossible to find some test which he cannot pass, he is put in jail for defying the officers of the Government.

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AEA

Engineering

AERIAL AGE
WEEKLY

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Photograph by U. S. Army Air Service

Airscape of the Military Academy at West Point

First Aerial Contest for the Pulitzer Trophy and Valentine Liberty Bond Prizes

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Like the Wings of a Bird!

Practical military and commercial aeroplanes are constructed on the cantilever principle.

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The first cantilever strutless aeroplane was invented, designed and patented by Doctor William Whitney Christmas, a native American, and successfully flown at U. S. Government Field No. 1, Mineola, L. I.

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VOL XII. NEW YORK, NOVEMBER 8, 1920 NO. 9

FIRST AERIAL CONTEST FOR THE PULITZER TROPHY AND VALENTINE LIBERTY BOND PRIZES

THE first aerial contest for the Pulitzer Trophy and the Valentine Liberty Bond Prizes will be conducted at Mitchel Field, Mineola, on Thanksgiving Day, November 25, commencing at 11 a. m.

PULITZER TROPHY

The Pulitzer Trophy, donated by Mr. Ralph Pulitzer to the Aero Club of America, is to be competed for annually, and will be awarded for one year to the club whose entry wins the contest each year and after this contest (The Aero Club of America will conduct the 1921 contest) will give the winning club the privilege of conducting the race the following year, subject to the rules and conditions made each year by the Aero Club of America. Should the club holding the trophy fail, or decline, to conduct the race within a year, the trophy shall be returned to the Aero Club of America who shall, at its discretion, hold the contest or assign it to another club.

Gold, silver and bronze plaques will be given each year to the winner of the first, second and third prizes by Mr. Ralph Pulitzer.

Valentine Liberty Bond Prizes

PULITZER TROPHY

FIRST PRIZE		
Pilot	$1500	(Liberty
Mechanics	300	Bonds)
	$1800	
SECOND PRIZE		
Pilot	$ 750	(Liberty
Mechanics	150	Bonds)
	$ 900	
THIRD PRIZE		
Pilot	$ 500	(Liberty
Mechanics	100	Bonds)
	$ 600	
Total,	$3300	

Class Prizes

Eighteen hundred dollars ($1800) in Liberty Bonds to be awarded the pilots and mechanics of planes finishing first and second in the three classes having, respectively, the greatest number of machines, provided that no class having less than four entries shall be eligible for these prizes.

Class prizes will be divided as follows:

FIRST PRIZE		
Pilot	$350	(Liberty
Mechanics	50	Bonds)
SECOND PRIZE		
Pilot	$150	(Liberty
Mechanics	50	Bonds)
	$600	

Conditions of Contest

1. FREE-FOR-ALL for AEROPLANES having—

(a) Factor of safety $\left\{\begin{array}{l}\text{monoplanes: six}\\ \text{biplanes: four}\end{array}\right\}$ as loaded for start of race.

(b) Air speed greater than 100 miles per hour, as loaded for start of race.

(c) Visability and maneuverability (land and air) which in opinion of Contest Committee of Aero Club of America is not a menace to the other contestants or spectators.

2. DISTANCE, APPROXIMATELY 160 MILES, four times around a closed course of 40 miles, viz: Mitchel Field, L. I., thence to Wantagh, L. I., thence to Babylon, L. I., thence return to Mitchel Field.

3. START.

(a) *The starting signal* will be given at 11 a. m. Aeroplanes to be on their allotted places on the field at 10 a. m. Pilots' meeting for the final instructions on the field at 10:15 a. m.

(b) *Position at start.* Planes competing for class prizes in addition to Pulitzer Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Pulitzer Trophy only will be sent away together after the classes. However, any entrant will be permitted to start alone after all classes, if this request is made to the Aviation Committee of the Aero Corporation, Ltd., in writing, before November 15, 1920.

(c) *Method of start.* The starter will assign an assistant starter to each plane, who shall raise the signal flags to and for its pilot, as follows: The starting signal (for motors only), a red flag will be raised by the chief starter at 11 a. m. When the motor of each plane starts, the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than 11:05 a. m., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds, giving the mechanics time to draw the blocks from under the wheels. Each second will be counted by lowering the red flag and the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red starting flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be allowed to start after any one plane has completed the full course, 160 miles.

4. THE FINISH.

The finishing time will be taken when each plane crosses the finish line between the marks defining this line, after having completed the full course, 160 miles.

5. THE WINNER of each first prize shall be the plane which has completed the full course in the shortest elapsed time, and of each second prize, the second best time, etc., provided the pilot is not disqualified.

6. QUALIFICATIONS.

(a) All pilots must hold an Aviator's certificate issued by the International Aeronautical Federation and duly entered upon the Competitors' Register of the Aero Club of America.

7. RULES OF THE COURSE.

(a) Pilots must hold a straight course after starting, until they have gone a distance to be specified and marked.

(b) A plane overtaken must hold its altitude and a true course, in order that it may not in any way impede or interfere with the faster overtaking plane.

(c) A plane overtaking a slower plane shall never pass or attempt to pass between that plane and any pylon or captive balloon marking a turning point.

(d) After crossing the finishing line, all planes shall continue on the course until they have attained the altitude of 2000 feet, then they may turn and return to the field, and land in that part of the field assigned for landing and in so doing shall not cross the course or finish line.

(e) No contestant shall start before he receives the getaway signal.

(f) Pilots shall pass all turning points in plain view of officials stationed at each point.

Any contestant breaking the above rules of the course, or subsequent ones which may be sent out in writing, shall, upon recommendation of the judges, be disqualified.

8. PROTESTS.

No protest shall be considered unless presented in writing to the Aviation Committee of Aero Corporation, Ltd., within twenty-four hours after the finish of the race.

9. NUMBERS.

Each aeroplane shall have the number assigned to it by the Aviation Committee, painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no other numbering or lettering over six inches in height.

Entry Blank

Name of Entrant..
Address..
Name of Aero Club of which entrant is a member..........
....
Make and type of aeroplane..................................
Make and type of motor, including H. P......................
*Factor of safety as loaded at start of race.................
*Speed as loaded at start of race............................
Name of pilot...
Address ....
Number of pilot's Aviator's certificate................
Names of Mechanics (eligible for prizes)....................
Addresses ....

* Unnecessary for DH's, Vought, Loening, SE5, Fokker, Larsen or 1920 Gordon Bennett models.

To the Aviation Committee of the Aero Corporation, Ltd.,
11 E. 38th Street, New York City

I, the undersigned, hereby make entry as a participant in the contest to be held by the Aero Corporation, Ltd., at Mitchel Field, Long Island, on November 25, 1920, and I transmit herewith my entry fee of one hundred dollars ($100) (Government entries accepted without entrance fee), this entry being made upon the following conditions:

(1) This entry shall not be effective until acceptance by the Aviation Committee.

(2) I agree to abide by the rules of the contest, which are part of this entry form, and those points not covered by these articles shall be subject to the rules and regulations of the International Aeronautical Federation and such special rulings as may be made from time to time by the Contest Committee of the Aero Club of America, and to enforce the obedience thereto of my agents, servants and representatives.

(3) That the decision of the Aviation Committee shall be final and binding upon me, my servants and representatives.

(4) I assume and accept full responsibility and agree to indemnify and save harmless the promoters and managers of the contest for any damage to persons or property caused by myself, my agents, servants or representatives, or arising from the operation, storage or maintenance of my machines, both during the continuation of the contest and during any period that I or my servants shall be using the field for training purposes.

(5) I agree that I shall abide by the decision of the Technic Committee of the Aero Club of America as to the factors of safety of my aeroplane entered in this contest, and to have it flown and timed over a measured course to determine its air speed, if the Aviation Committee request it.

(6) I agree to abide by the decision of the Aviation Committee to postpone the race, if in their opinion, the weather is not suitable.

(7) It is understood that my deposit of one hundred dollars ($100), shall be returned to me if this entry is not accepted, or, if accepted, if and when my aeroplane is on the field ready to start the morning of the contest.

(8) Announcements or notices sent to me or my pilot shall be deemed properly addressed if directed to us at the addresses shown above.

(9) I agree if required to abide by the decision of the physician appointed by the Aviation Committee, as to the physical fitness of myself or pilot to compete in this Contest.

Signed..................................
Date.......................19....

Entries close November 15, 1920. Entries received subsequent to November 15, 1920, shall only be accepted with the written consent of all entrants.

THE NEWS OF THE WEEK

Aviators' Reunion Dinner

Famous generals, admirals, flying aces and much-decorated war veterans from every branch of service will be forced to vacate the place of honor in favor of a very small, but very important, much-scarred and marked battle flag which will occupy the place of honor at this year's Aviators' Reunion Dinner to be held at the Hotel Astor, New York City, Armistice Night, November 11th, according to an announcement made by the dinner committee at the club house.

The little flag, a priceless one amongst veterans of the Foreign Legion and Air Service, is covered on both sides with signatures of men famous in battle ranks, many of whom died in action. It has been handed down from the Second Regiment of the French Foreign Legion through the Legion ranks, the LaFayette Escadrille and finally, America's own Aerial branch. Always carried by an American and carefully guarded, it was finally brought to this country by Captain James Norman Hall, famous writer, soldier and ace flyer.

When Captain Hall was serving in the ranks of "Kitchener's Mob" in 1914, the little guest of honor was waving over Bill Thaw, Norman Prince, Rockwell and Charlie Sweeney, then privates in France's famous Foreign Legion in the First Battle of the Marne.

The dinner committee composes Charles W. Kerwood, Chairman; Cole J. Younger, Treasurer; Eddie Rickenbacker, James B. Taylor, Jr., Commander A. C. Read, Elliott Springs, Chas. Hanson Towne, Harold K. Hartney, F. H. LaGuardia, Maurice J. Connolly, Charles J. Biddle, Douglas Campbell, Joseph Knowles, Jr., Archie L. Heath.

Air Race Won By Belgian Balloon

The Aero Club of America, in an unofficial statement, placed the Belgian balloon Belgica, which landed at 9:30 A. M., October 28, at North Hero Island, Vermont, first in the Gordon Bennett international balloon race.

The distance covered by Belgica, in charge of Lieut. De Muyter and Lieut. Labrousse, was estimated at 1,100 miles. The American record is 1,173 miles, made by Alan Hawley and Augustus Post, in the International event in 1910.

The American balloon Kansas City II, with H. E. Honeywell and Jerome Kingsbury, was placed second in latest reports. This entry, which landed at Tongue Mountain. Lake George, N. Y., was estimated to have covered more than 1,000 miles.

The Italian entry, with Major Valle in charge, which landed at Homer, N. Y., after forty-eight hours in the air, was within twenty-six minutes of the American record, the Aero Club said. This record was made by Clifford B. Harmon and Augustus Post in a national race in 1909.

Another American entry, the army balloon commanded by Capt. R. E. Thompson, had not been reported October 28, and Aero Club officials said it may have travelled further than Belgica.

Since the hop-off in Birmingham, Ala., Saturday, nothing has been heard from this entry. It was regarded as probable that Capt. Thompson had found a favorable current of air and pursued it without passing near any place of communication

Ralph Upson, pilot of the Goodyear II, in the international race, which landed at 5 o'clock yesterday afternoon at Amhertsburg, Ont., across the river from Detroit, in a telegram to the Aero Club said he was forced down by a heavy snowstorm encountered at 20,000 feet.

Lieut. De Muyter, pilot of Belgica, sent word of his landing, saying his descent was forced because he was out of ballast. The balloon crossed over the Great Lakes and the maximum height reached was 20,000 feet, at which a heavy snow and rain storm was encountered.

Apply Quarantine Rules to Aeroplanes

Washington.—Aeroplanes entering the United States from foreign countries will be subject after Nov. 1 to the same quarantine regulations as apply to steamers, it was stated at the Public Health Service.

The first aeroplane health inspector will be at Key West, Fla., where many planes arrive from Cuba. The aeroplanes must obtain bills of health from the American Consul at Havana before leaving that city.

Aerial Police Have New Field

The second aviation field of the police reserve, situated on the Shore road extension opposite Fort Hamilton in the Bay Ridge section of Brooklyn, was opened for use October 23.

Fiorelo H. La Guardia, President of the Board of Aldermen, and Major of aviation during the war, made an address. Police Commissioner Enright, Mayor Hylan and other officials were invited by Rodman Wanamaker, Special Deputy Police Commissioner, who is in charge of the police reserve.

By Flying Boat to Hudson Bay

The world will have the privilege of seeing what a wonder country lies to the north of Old Ontario, and for it can thank the Canadian Aero Film Co., Limited, who recently sent a hydroplane on a pioneer flight from Toronto to the Hudson Bay, via Algonquin Park and the Ottawa Valley. The distance of nearly 900 miles was accomplished in a little over eight hours' time.

Five passengers and equipment were carried. The party included Irwin Proctor, president of the Canadian Aero Film Co., Ltd.; F. H. Blake, editor of the Provincial Motion Picture Bureau; Roy Tash, camera man; W. R. Maxwell, pilot; Geo. Doan, mechanic, and E. Ireson, Provincial Government engineer.

"I doubt if, for beauty, the country can be surpassed in the world," said Mr. Proctor. "At one time I counted over one hundred little lakes beneath us nestling among the trees. We soared over parts of the country up to the present practically unknown to white men. We were able to get an accurate report for the Government in a length of time that ten parties of men would have taken years to secure."

Spruce timber for pulpwood, and moose are reported to be plentiful.

A comparison of aeroplane as against canoe and horse was made from Cochrane to Hudson Bay, resulting in it taking eleven days for a party of mounted police to cover the same distance that the birdmen passed over in two hours and five minutes.

Japanese Air Mail Will Begin Soon

Tokio—Inauguration of an air mail service by the Japanese Department of Communications is expected to take place before the end of the year. Investigations as to the existing state of aviation in Japan, the number of aviators, their education, the capacity of Japan to manufacture aeroplanes or other planes, are now being made. Also the aerodomes, the air routes, etc., are being inquired into.

The opening of the air mail service is expected to occur soon after Mr. Oyamada, an official of the Department of Communications who was sent abroad to investigate, returns to Tokio.

It is understood the first route to be tried will be between Tokio and Osaka, which was experimented upon by the Imperial Aviation Society last year, in the contest conducted then. The routes to Kyushu and Shikoku will be investigated when the second contest for long flights will be given next month. It is understood that the opening of all other routes will also be entrusted to the Imperial Aviation Society.

Use Planes for Debs

Toledo—Toledo was bombarded October 31 by aeroplanes carrying Socialist literature in behalf of Eugene V. Debs, Socialist candidate for the presidency. Thousands of pounds of literature were dropped from four passenger-carrying planes which soared high above the city.

Each piece of literature was stamped with a letter of the alphabet. To make it more attractive it was announced that any four persons finding four letters of Debs' name would receive a cash prize.

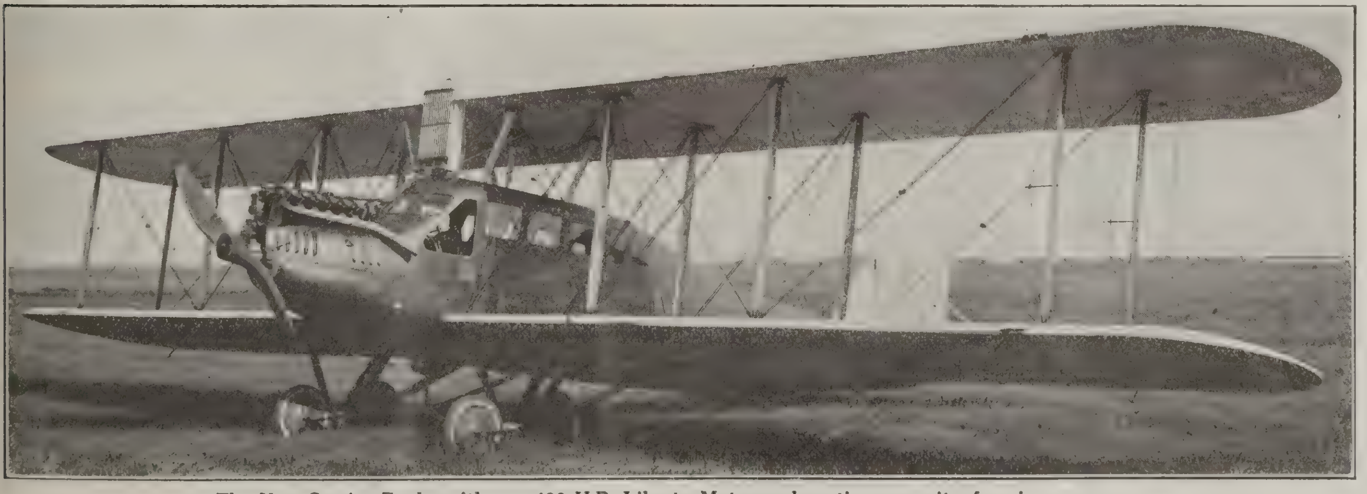
At a mass meeting in Labor Temple Debs was lauded by a large audience for the "stand he has taken for the workingman."

Mexican Officials Given Flights

Last week an official visit was made to Fort Bliss by several Custom and Consular officials of Juarez. At the Post Commander's request, four of the visitors were taken up for flights lasting about forty-five minutes. General Fox, commanding the Juarez garrison, was proud to hold the altitude record for the visitors, reaching an altitude of 5,000 feet, and all expressed themselves as having had a most enjoyable flight.

Glidden World Tours Incorporated

Arrangement have been completed for the incorporation in New York of the Glidden World Tours, Inc., to encourage travel in all parts of the world by rail, steamship, automobile, and aircraft, through the organizing and conducting of touring parties. The Company will be under the general direction of Major Charles J. Glidden. Offices will be opened in New York and San Francisco with connections in all parts of the world. Tourists will have the option of traveling part or all the way by aircraft.



The New Curtiss Eagle, with one 400 H.P. Liberty Motor and seating capacity for six passengers

The AIRCRAFT TRADE REVIEW

Plan Los Angeles-Bear Valley Aeroplane Service

Los Angeles.—Preparations for a regular aerial service to Bear Valley to be operated both in summer and winter, are being made by the Bluebird Aviation Company, under the direction of D. D. France, according to George B. Harrison, secretary of the Aero Club of Southern California.

The tentative plans call for the use of Standard planes, equipped with Hall-Scott L-6 motors. A landing field will be used at Ontario as a fueling point between Los Angeles and the valley.

For winter service, when Big Bear Lake is covered with ice and snow, it is said that the planes are to be equipped with snow skids, similar to those commonly used on sleds.

Canadian Aircraft Industry

The Air Board has issued a plan of action for the future, and have under consideration the standardizing of a machine for truly Canadian purposes. The Board has always favored British machines in Canada, and now comes the time—"Canadian machines for Canada." If the Air Board desires a certain type of aircraft for forest protection and photographic exploration, "why not raise up a Canadian industry to supply Canadian needs," say the Canadian prospective manufacturers.

Wright Sues for Patent Rights Infringement

New York.—Suit has been brought by the Wright Aeronautical Corp. against Handley Page, Ltd., the Aircraft Disposal Co., Ltd., and William H. Workman, in the United States District Court, for alleged infringement upon patent rights. Injunctions and an accounting of profits are asked.

The action is based on patents issued in 1906 to Orville and Wilbur Wright, and which were transferred to the Wright Aeronautical Corp. last October.

Navy Building Eight Super-Seaplanes

Super-seaplanes, with a cruising radius sufficient to enable them to cross the Pacific Ocean, are under construction and probably will be available for use by the navy department next spring, according to an announcement by the Manufacturers' Aircraft Association.

Eight torpedo seaplanes with a cruising radius of 400 miles, the association announced, are en route from Cleveland to San Diego, Calif., where they will be stationed, cooperating with the Pacific fleet and supplementing the coast defenses.

The planes are traveling aboard twenty-three cars, comprising the largest shipment of fighting aircraft since the armistice.

Each of the torpedo planes has a total gross weight of 11,910 pounds, including a load of 4,950 pounds. In addition to pilot, navigator and gunner, each machine will carry a 1,650-pound torpedo, 450 pounds of bombs, two machine guns, various instruments and accessories and fuel for four hours operation.

Army Building "Aerial Tanks"

Designed to successfully resist shrapnel and small arms projectiles, ten heavily armored triplanes are to be built for the United States Government by the Boeing Airplane Company of Seattle. Production on the first plane has already commenced.

These planes, representing a new type of construction, are designed to serve in aerial service for ground attack, having a function similar to that of tanks on land. Quarter-inch chilled steel armor protects the pilot, observers, and vital portions of the plane. The armament includes a thirty-seven millimeter rapid fire gun mounted in the front, four machine guns trained to fire through the floor, two machine guns at the back, and two above the wings.

With every gun in action over 7000 bullets a minute may be fired.

Each triplane is to carry a crew of three or four men. The total weight of the planes is about three and a half tons, one ton of which is represented by armor plate. The design was developed by the Army Air Service.

The Westland 6-Seater

This machine is similar to the Westland Limousine in construction, but is larger.

It is fitted with a tail-trimming gear so that no ballast is necessary. For heating in cold weather, there is a heating box alongside the center exhaust manifold which introduces hot fresh air into the diffuser box. The principal dimensions are:

Weight fully loaded	5,550 lbs.
Napier Lion Engine	450 b. h.p
Surface planes, ailerons and center section	726 sq. ft.
Span (both wings)	54 ft.
Chord (both wings)	7 ft. 3 in.
Height (overall)	12 ft. 6 in.
Length (overall)	33 ft. 6 in.
Gap	7 ft.
Stagger	9 in.
Incidence	2.75°
Dihedral	2.5°
Tail plane	40 sq. ft.
Elevators	30 sq. ft.
Fin	9.8 sq. ft.
Rudder	15.9 sq. ft.
Ailerons (each)	27 sq. ft.
Propeller	2,980 mm. diam.
Petrol capacity	96 gals.
Oil capacity	7½ gals.
Water capacity	10 gals.
5 passengers and pilot or mails	1,200 lbs.

Seven Entries in First Aerial Derby Around the World

Major Charles J. Glidden, Executive Secretary of the Commission, which organized the First Aerial Derby Around the World, who is maintaining an interest in the great event pending the formation of rules under direction of the Federation Aeronautique Internationale and the improvement of the political situation in Mesopotamia, one of the countries over which the contestants must pass, announces the following entries for the contest: International Aerial Navigation Co., St. Louis by C. J. Couterman; Umberto Goio, Panama; W. Maun, Bombay, India; Etienne Poulet, Paris, France; Harry Burton Lewis, Hon. Lieutenant Royal Air Force, London; Western Airline Syndicate, by M. H. Hill, Cincinnati, Ohio; H. W. Hoyt, Lieut. Royal Air Force, Howden, England.

Naval Airship Makes Long Flight

Washington—Naval airship D-2, which flew successfully from Akron, Ohio, to Langley Field, Virginia, has been delivered to the army air forces stationed there. Commanded by Lieutenant C. E. Baugh, the ship made the trip in ten hours and forty-five minutes.

It is the largest craft of the type yet built in the United States, and has 186,000 cubic feet gas capacity. The navy turned the vessel over to the army as it had no shed available for housing it.

To Use Aeroplanes in the Antarctic

John L. Cope, late commander in the British navy, left New York recently for Norfolk, Va., whence he will sail on the most ambitious polar expedition ever undertaken. Utilizing three oil burning ships, three aeroplanes capable of crossing the ice on sledges if need be, dogs from the Hudson Bay country and wireless on the planes and at land stations to be established, he and his English companions purpose to circumnavigate and explore the Antarctic continent.

Federal Aerial Control Needed

Glenn L. Martin, discussing in a newspaper interview recently, had the following interesting comment to make on the necessity of Federal aerial control:

"The necessity for adequate Federal legislation is felt wherever there is flying, but, due to the delays in formulating a national air policy there is not a general understanding of the subject," Mr. Martin said. "Municipalities suffering from reckless piloting have in some instances felt impelled to adopt regulatory ordinances. But they no sooner do so than they realize the impossibility of enforcement. Consequently such civic regulation as exists is largely quiescent.

"A few States, among them Ohio and New York, have formed aviation commissions, and these bodies have found themselves unable to aid except to memorialize Congress for speedy Federal action. Even States would find it futile to endeavor to regulate the air, traffic in which is developing at tremendous speeds, making it possible to traverse enormous distances in a single day. In the meantime the manufacturers of aircraft are doing what they can. They enforce rigidly the flying rules at their various fields and they exercise such supervision as is possible over aircraft that have left their direct control. But this is inadequate. Federal inspection of ships and licensing of pilots and navigators should be provided for by an act early in the next session of Congress."

KEY WEST-HAVANA AIR LINE INAUGURATED

MONDAY, November 1, 1920, will go down to history as an epoch-making date, one that will fully rank in significance with the trials of Fulton's steamship and with the inauguration of the first railway between New York and Albany; for on that day the first American passenger air line came into existence, to operate on a daily schedule between Key West and Havana. Six Aeromarine cabin flying boats of the largest size ever used for the transportation of passengers were put into service between the extreme tip of the Florida Keys and the Cuban Capital. These big boats, which have a span of 104 feet and are fitted with two 400 horsepower Liberty engines, afford luxurious accommodations to eleven passengers who will be agreeably surprised to find there all the comforts a private yacht or a high class limousine offers.

The forward cabin, which is reached through a hatch in the bows of the boats, has six big chairs upholstered with leather, each with its individual window, so that the passenger may have an unobstructed view of the panorama which reveals itself underneath.

From this cabin a passageway leads to the rear cabin, which seats five passengers and which is intended to be used for smoking, writing or card playing. The interior of both cabins is finished in mahogany and silver, and dome lights are provided for night flying. The rear cabin also communicates, by means of a second hatch, with the deck.

Between the two passenger cabins is situated the control compartment, housing the dual control gear (which enables the pilot to surrender control at any time to his assistant) and the necessary air navigation instruments, such as air speed indicators, revolution counters, pressure gauges, compass, etc. Three men make up the crew of the Aeromarine flying cruisers, namely, two pilots and a mechanic.

While the passengers are entirely sheltered against the rush of air and the weather by the enclosed cabins, the pilot compartment is an open cock-pit in order to give the crew the greatest possible visibility in thick weather.

While the manifold advantages which a regular passenger air line between Key West and Havana would afford to the traveling public have for a long time been obvious to keen observers, it is realized at the same time that to run such a service with the reliability the public would be justified to expect and demand extremely dependable aircraft. The latter did not exist prior to the Great War, but today they are a reality.

The type of aircraft which will be used on the Key West-Havana air line is a development of the F-5-L flying boats which the United States Navy produced during the war for extended anti-submarine patrols, both in home waters and in the North Sea.

The splendid war record of the F-5-L flying boats prompted the Navy Department to retain them as part of their peace time establishment. Squadrons of these boats have been attached to the Atlantic and Pacific fleets and have accompanied our battle squadrons far out to sea in the capacity of long range scouts. Several of them have successfully made trips between New York and Florida in the hands of Navy pilots and one of them succeeded last spring in establishing a new world's duration record for seaplanes by remaining continuously in the air for twenty hours and nineteen minutes, thus covering an estimated distance of 1,250 nautical miles. It will be of interest to know that this distance slightly exceeds the longest leg the famous NC flying boats covered in their epoch-making trans-Atlantic flight.

Such performances speak for themselves. Add the fact that these boats are fitted with two engines, either of which is able to sustain the machine in flight, while the mechanic inspects the stopped engine, and you have the explanation of the great reliability of this type of aircraft.

The desirability of converting the F-5-L boat into a comfortable passenger carrier impressed many students of aeronautical affairs, and as a result the Aeromarine Plane & Motor Company of Keyport, N. J., produced last summer such a craft. This machine, called the Aeromarine Type 75 Navy Cruiser has since its successful trial flight transported hundreds of passengers with the utmost safety and comfort from New York to Atlantic City, to Southampton, L. I., to Newport, R. I., and to several other places along the Atlantic Coast.

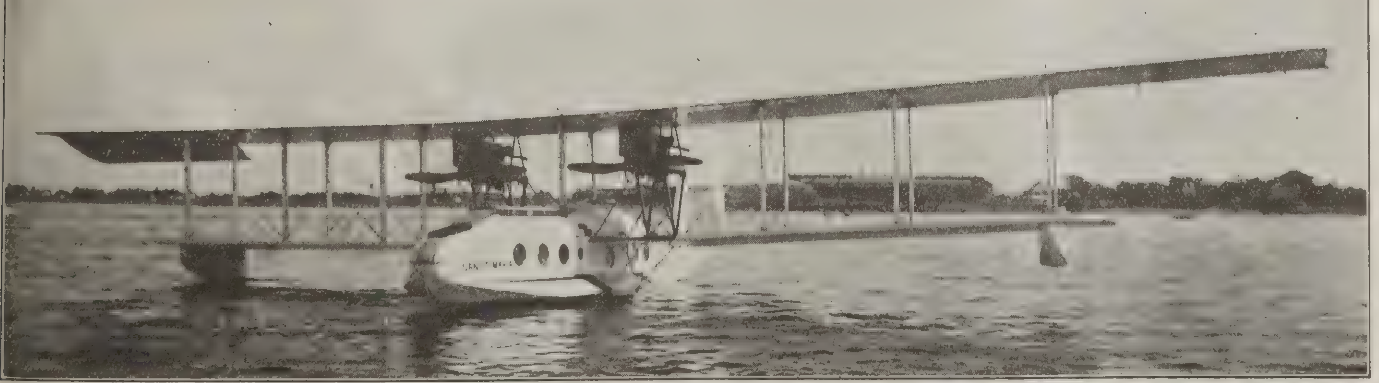
Interior view of the Aeromarine Passenger Cruiser

Therefore, when the Post Office Department demanded bids on a contract to carry first class mail on a daily schedule between Key West and Havana and return, the greatest difficulty, which as a rule confronts organizers of air lines, the problem of finding a suitable machine—was already overcome. Hence, when the contract was awarded to the Aeromarine West Indies Airways, Inc., all that remained to be done with regard to the equipment was to duplicate a well-tried type of machine. This has proceeded at the Keyport plant of the Aeromarine Company with record speed; two of six boats are completed and the remaining four will be ready to follow in a few weeks.

Of course, an air line is not entirely run on equipment for the human factor holds a very important position in this line of activity as in any other. The question of the personnel is one of the most delicate that confront air transport firms, for it is the efficiency of both pilots and mechanics that determine the reliability of an air line. The pilots, who fly the machines, and the mechanics, who keep them in trim on the ground, naturally require to be selected with the greatest care.

The Aeromarine West Indies Airways, fully realizing the importance of the human element, took the greatest pains to select its flying and ground crews with great discrimination. Pilots and mechanics were taken from among the best men both of the American and British air forces and the only difficulty experienced was that of choice among so many good men whom the Armistice had deprived of an occupation which through the war had become their second nature.

The vice-president and general manager of the company, Major Geoffrey H. Bonnell, late of the Royal Flying Corps, is



The Aeromarine West Indies Air Cruiser in service between Key West and Cuba the direct supervisor of the operating force. Major Bonnell has acquired a great deal of valuable experience in the training and maintenance of flying squadrons during the war, which should prove considerable assistance in establishing and maintaining a high standard of reliability in the operation of the new air line.

Among the pilots who will handle the big planes are Lieut. John W. Iseman, late of the United States Navy, Capt. T. L. Tibbs, R. A. F., who won distinction as an aviator in France, and Lieut. Alvin W. McKaig, a well-known aeronautical expert.

Although the distance between Key West and Havana is only a matter of 90 miles, which the big aeromarine flying boats will manage in a little more than an hour—whereas the water route takes up a whole night—the aerial passengers need not fear that they will be out of communication with the rest of the world while *en route*. Arrangements entered into with the Navy Department will enable the big flying boats to keep in communication, through wireless, with the naval base at Key West and its patrol boats operating therefrom. The Key West naval base will also provide the two terminal points of the passenger air line with weather forecasts and storm warnings. As it is possible to forecast storms in that region at least six hours in advance of their occurring because of static disturbances which interfere with wireless communication, it will be possible to run the service with the greatest amount of precautions the human mind can devise.

The main idea back of the new air line being to give the passengers, beside comfort and fast travel, the utmost safety, the machines will not transport passengers in very bad storms, although the mail would probably be carried through just the same. For it has become the proud tradition of the air mail service that nothing short of a hurricane can deter a mail pilot from doing his duty and there have been cases where the air mail has reached its destination despite a wind blowing at 100 miles an hour, which is a sizable hurricane. But as far as the passengers are concerned, the Key West-Havana air line will have for its slogan "safety first, last and all the time," so that the traveling public may take the aerial passage without the slightest misgivings.

THE NEW HANDLEY-PAGE WING

A BRIEF indication of the lines along which the Handley Page Company are working on their new wing was given to representatives of the press at the Cricklewood Aerodome on October 21st. The development achieved in the construction of this "new wing" appears to be still in its very elementary stage and no definite statistics or technical data are yet available as to the "high-lift" and "low-landing speed" which are claimed for a machine constructed on their new lines. A full-scale model has not yet been built and the public demonstration of the "new wing" consisted of several flights being made with a partially converted D. H. 9 machine. From the accompanying photograph it will be seen that a small deeply cambered wing was *fixed* to the leading edge of the ordinary wing, and with even this slight modification, the machine appeared to "take-off" and "land" in a much shorter space than a similar machine constructed on the usual lines. The speed in the air, however, seemed to be considerably affected.

Briefly, the idea of the "new wing" appears to be, to have a wing surface made up of a number of small wings, each deeply cambered, overlapping, and in general appearance very much like a Venetian blind. By a mechanical device (which has not yet been demonstrated and which appears to present considerable difficulties) thee small wings can also be raised or lowered at the will of the pilot. This latter feature is certainly a most intricate and interesting one, and will undoubtedly be of great assistance if it can be successfully achieved. Up to the present, however, its development is still in the embryo stage, and progress must be awaited with patience, though the final demonstration of a full-scale model will be an event of more than ordinary interest.

The Handley Page Company have issued the following statement:

"The special feature of the new Handley Page Wing is, that by its use, landing speeds far slower than those obtained up to the present will be possible, or conversely, greater loads can be carried or higher speeds obtained with the same horse power.

"Another special feature of the Handley Page Wing is that it has very much greater lift for every square foot of its surface compared with an ordinary wing, and this is accomplished by a most simple wing construction, which at first sight would seem to reduce rather than increase the lift of the wing. The construction consists in having slots right through the plane, connecting the lower and the upper surfaces, and to the uninitiated it would appear that these slots, allowing the air to escape from the under to the upper surface of the wing, took away all the lift. Strange as it may seem, the reverse is exactly the case. The slots in the wing virtually convert a single wing into a number of wings, and increase the lifting power of the wing two or three times as much as in the ordinary construction.

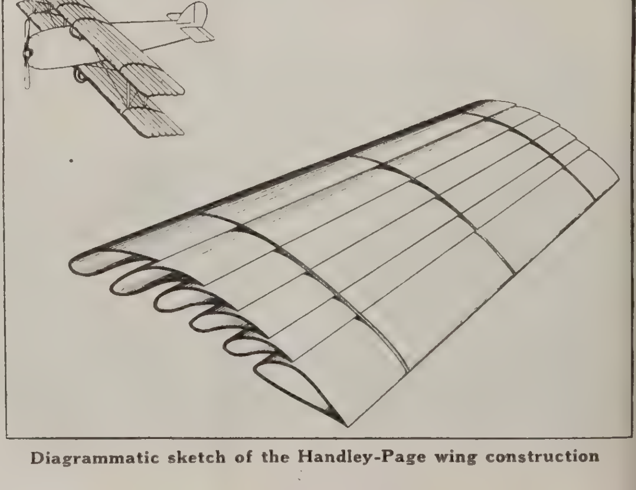
"Supposing, for instance, that a machine to-day lifts a total weight of a ton and a half and has a wing area of 400 square feet. With the new construction it will be possible to lift the same weight with a wing area of only 200 to 300 square feet. In consequence, owing to their smaller size, the wings can be built much more stoutly without increasing the weight, and so all-metal wings become much more possible commercially.

"Beyond this is the further and most important feature. With the high-lifting capacity of these wings it is possible to fly more efficiently at full speed. The new wings at full speed are inclined at larger and more efficient angles than heretofore, so that the lift is obtained with much less horse power to drive the machine through the air. Up to the present it has not been possible to design machines heavily loaded and efficient such as this, because it would have meant the commercially impossible landing speeds of 70 to 80 miles an hour. Now, however, with this new construction, landing speeds smaller even than those now usual have been obtained with all the advantages described above.

"It is from a fundamental advance such as this that progress in aircraft will be made. First comes the improvement in basic principle, next the adaptation to engineering design and lastly operation in service at a decreased cost and with increased reliability to the public. Time must elapse before the public will benefit from these advantages. Minor improvements may be necessary for their full advantage to be gained, but there is no doubt that it is on advances such as these that the whole future of aircraft development depends.

"In viewing to-day the aeroplane fitted with an early type of this slot, it is possible to see the beginning of the practical accomplishment in flying of what laboratory tests have shown can be finally accomplished."

A reconstructed De H. 9 with one of the Handley-Page wing features

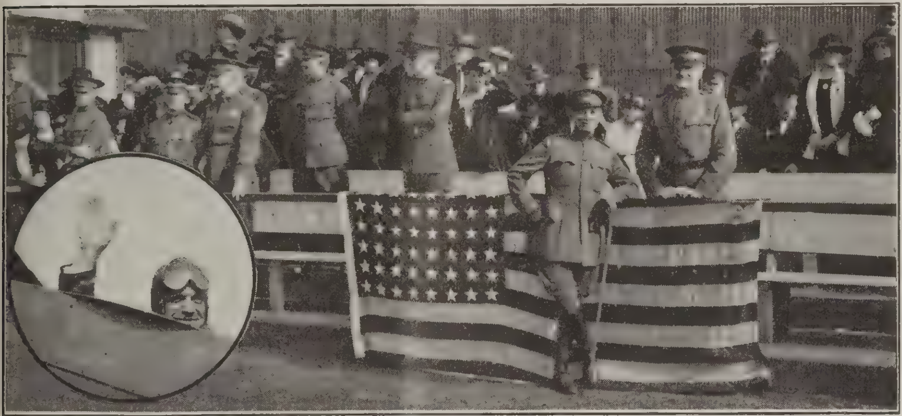


Diagrammatic sketch of the Handley-Page wing construction

RETURN OF THE ALASKAN EXPEDITION

THE Alaskan Flying Expedition has made its contribution to the history of aviation. The 9,000 miles from New York to Nome and return has been cut to, approximately, 110 flying hours. The greatest pioneering feat attempted by the Army Air Service ended successfully when the four DH-4 planes, running their original motors, landed at Mitchel Field in the afternoon of October 20th, having been escorted from New York to Mineola by an aerial fleet.

After a night's rest, the officers and men comprising the expedition proceeded, on the morning of the 21st, to Washington, D. C., where a reception was accorded them befitting an occasion so notable in the history of aviation. Flying a DH-4 plane, General Charles T. Menoher, Chief of the Army Air Service, met the party in the air and escorted them to Bolling Field. Also in the receiving party, were General William Mitchell, Chief of Training and Operations, commanding the 99th and the 10th Observation Squadrons; Colonel William H. Hensley, Jr., the foremost airship pilot in America, who crossed the Atlantic in the British R-34, commanding the U. S. ZD No. 1, flying up from Langley Field with a full crew of 24 officers and men. Each Squadron consisted of 18 planes flying in vee formation, making a total of 54 Army planes, in addition to which were a number of civilian aircraft which also took the air to honor the return of the daring and intrepid aeronauts.



The official receiving stand at Bolling Field. General John J. Pershing, Major-General Peyton C. March, Brig.-General William Mitchell are in the group, and Major-General Charles T. Menoher, in the insert, who flew to Baltimore to welcome the returning fliers

It is regretted that the Secretary of War was out of the city and so could not be present, but invitations were extended by the Chief of the Air Service to General Peyton C. March, Chief of Staff; to General John Pershing, Commander of Armies of the United States; to Secretary of the Navy Daniels, and other officials to be of the party to greet the members of the expedition as it landed at Bolling Field.

Most touching was the meeting of Captain Street and his mother who was at Bolling Field to greet her son. Captain Street is the only one of the returning airmen so fortunate as to have his home in Washington.

Captain Street made it clear that regular air service to Alaska is practicable. He says the Alaskans are anxious to see such a service established, and that a movement is on foot to secure the co-operation of the Canadian Government in the undertaking.

The aviators told many interesting stories of their trip. At some landing places along the way game was plentiful and fresh meat was always available. The fliers sighted herds of reindeer and caribou, and often saw bear, mountain sheep and other game. A school of white whales and many seals were sighted in the Bering Sea.

Captain Street said that the expedition failed to obtain as many pictures as they had hoped because of poor visibility. In bad weather it was necessary to fly high in order to avoid hitting mountain peaks, a good portion of the journey having been made at an altitude of 8,000 feet. Hundreds of miles of the territory covered had not been mapped, and the only information available was what they could learn from trappers. Pictures which were obtained will be turned over to the Geodetic Survey.

The reception to the Alaskan party ended with a dinner to officers and men at the Army and Navy Club. This courtesy was extended by Generals Menoher and Mitchell and the Chiefs of all Groups and Divisions of the Air Service.

The personnel of the expedition are all picked men, men who have proved their fitness and ability for so hazardous and important a task.

Captain St. Clair Street, piloting plane No. 1, in command

Capt. Douglas, Lieut. Crumoine, Lieut. Kirkpatrick, Lieut. Nelson, Sergt. Albert Vierra, M. E. Joseph English, Sergt. E. Henrigues, just after their arrival at Bolling Field. Capt. Street was immediately taken in hand by General Pershing and therefore is not included in the group

of the expedition, was stationed at the training camp at Issoudun, France, during the war, being one of the first aviation officers sent overseas. He was decorated by General Pershing. Sergeant Edmund Henriques, his mechanician, is one of the most experienced men in the service.

Plane No. 2, piloted in turn by First Lieutenant Clifford C. Nutt, and Second Lieutenant Eric C. Nelson, engineering officer. These two officers made a year ago, without accident or mishap of any kind, a successful recruiting flight from Houston, Tex., to San Diego, Calif., by way of Omaha, Neb., and Denver, Colo., and return, a journey of 7,000 miles.

Lieutenant C. H. Crumrine, the photographic officer, piloted plane No. 3, with Sergeant Albert I. Vierra, one of the most experienced Liberty motor experts, as mechanician. Lieutenant Crumrine is an experienced pilot, having been stationed at Carlstrom Field, Florida. He will be remembered through his connection with the finding of Lieutenant Niergarth, the airman who was lost in the Everglades.

Lieutenant Ross C. Kirkpatrick, A. S. A., who made a distinguished record in the trans-continental endurance and reliability flight, the information officer of the expedition, piloted plane No. 4, with Joseph E. English, M. E., as mechanician.

The Alaskan Flying Expedition, successfully completed one of the most hazardous and stupendous aerial events yet attempted in any country. When it is considered that these fliers had to proceed over at least 2,000 lineal miles of virgin territory far remote from habitation, without a landmark to guide them, nor a field upon which to alight, over jagged mountain peaks and endless snow-covered glaciers, and over 7,000 miles of country encountering the greatest menace to airmen, fog, yet pushing dauntlessly on against all kinds of odds, one must conclude that this was one of the greatest efforts of pioneering work yet accomplished by the Army Air Service.

The British last spring attempted to fly from Egypt to the Cape, over the wilds of Africa. One pilot reached the destination, but only after he had replaced his machine and motors, and after much delay and inconvenience. In the Alaskan flight, on the other hand, thanks to the efforts of the Commander, Captain St. Clair Street, and the personnel of his party, despite discouraging delays and the worst possible weather conditions, the expedition pushed on and on, flying successfully the same planes with the same motors a distance of 9,000 miles, with scarcely a change of spare parts or equipment throughout. In the Trans-continental Reliability Test last autumn, Lieutenant Belvin Maynard, the winner, broke his motor near Omaha, and had to change it entirely before proceeding. Only one Liberty motor succeeded in making the journey both ways, and this was piloted by Lieutenant E. A. Manzelman, who took pride in his motor, and who felt that by nursing it along and caring for his machine, as such a fine piece of mechanism as an aeroplane should be cared for, he would gain a victory more pronounced than the saving of a few moments of time with the sacrifice of a valuable engine.

Compared to the non-stop flight made by the Englishman, John Alcock, which gained for him recognition from the British Government in the form of knighthood, most fliers will agree that the Alaskan flight is a greater feat. Alcock's undertaking, though marvelous and unprecedented, was, to a certain extent, a wager wherein the stakes and the odds were great, but the effort was only 16 hours' continuous flying with the chance of a failing motor. The Alaskan flight was a steady grind of over three months' duration. Only those who have flown on expeditions of this nature can appreciate the state of mind of the pilots as they awoke each morning to realize the hazardous undertaking they had attempted and the long day's flight over uncharted airways before them.

Compared to the flight of the NC-4 across the ocean, the Alaskan expedition ranks high. Commander Reid had only one landing to make, at the Azores. Commander Street and his men were compelled to land fifty times on strange fields and, in one instance, on wholly impossible ground. To successfully reach these fields was a big task in itself, but to land an aeroplane without crashing was a problem that did not appear in the NC-4 flight. It took skill, courage and determination to fly from New York to Erie. It took superhuman qualities of this nature to fly to Nome and back.

The Alaskan Flying Expedition exemplifies more conclusively than any similar effort the energy, intelligence and initiative which the United States Army Air Service is exercising in demonstrating the definite and practical purposes to which aviation can be applied. In many instances it has been left to individual effort and private enterprise to test the practicality of an invention or an idea. In the matter of aviation the Government is, in most cases, going ahead of, and in every way possible, is encouraging and assisting, individual effort and private enterprise.

The Alaskan flight had a definite and practical purpose and was carefully and definitely planned.

In preparation for the flight Captain Howard T. Douglas, A. S., made a preliminary tour over the proposed route arranging for landing fields and supply stations, receiving everywhere the co-operation and assistance of Chambers of Commerce and of influential citizens. In the entire arrangement and carrying out of the expedition, the Canadian Government, through its Air Board, lent its co-operation and support, an officer of the Air Forces traveling with Captain Douglas after he reached the Dominion, and further arranging for oil and gasoline to be shipped free of duty to the various supply depots along the proposed route. The Weather Bureaus of both countries co-operated in furnishing necessary reports for the flight.

The purposes of the flight were far-reaching, though they may be stated quite simply. First to establish a route to the farthest northwest limit of United States territory. The benefits to be derived from such a route are self-evident; it will bring the people of Alaska nearer to the people of the United States; it will make a relay air mail service to the far northwest possible. Second, the expedition will prepare photographs for use of the Geological Survey of 3,500 square miles of unsurveyed territory stretching from parallel 66 to the Arctic circle. It is estimated that the cost of the air survey would be, approximately, $1,500, allowing for the photographic work to be made from one plane in ten flying hours. In comparison with these figures, a ground survey would cost, at the minimum, $10,000, and would stretch over a period of three years by reason of the limited season during which such work could be undertaken in that far northern region.

Still another practical end which the expedition had in view, was the thorough testing of the new model De Haviland 4-B plane. In the new model, as is well known, the gasoline tank has been changed to a position immediately behind the engine, thus lessening the danger to the pilot, whose position in the old model was between the motor and the gasoline tank. The Alaskan flight has proven the new model's ability, and points to further development.

The Line-up for the Start of the Memorable New York-Alaska Flight

THE LAIRD "SWALLOW"

ONE of the recent popular aeroplanes is the new Laird "Swallow", which was designed to meet the requirements of a commercial aeroplane, being especially adapted to passenger carrying and cross country flying.

This machine has given excellent performance tests, and has proven very efficient. It is powered with a Curtiss AX-5 90 horsepower engine, and has a carrying capacity of three persons, with a high speed of 86 miles an hour and a landing speed of only 38 miles an hour.

Main Planes

The R.A.F. No. 15 wing section is employed. Wing chord—58 inches. Wings are in four main panels, aside from the center panel, which is 30 inches wide. Upper and lower panels are interchangeable. Gap between wings—58 inches. Dihedral angle, upper and lower wings, 1.5 degree.

Ribs are built of grooved spruce battens, screwed to the basswood webs, which are lightened between spars. Internal wiring is with No. 10 hard wire.

Best grade of Irish linen is used for wing covering, coated with dope, over which is applied two coats of color varnish in any desired color, blue gray being standard finish unless otherwise specified.

Seating Arrangement

The front cockpit is arranged to accommodate two passengers side by side, it being luxuriously upholstered. Carpeted floors and inclined foot rests add much to the comfort of the passengers.

A large windshield of transparent celluloid built up with aluminum framework is attached to the cowling in front of the passenger's cockpit. This offers protection from the wind to the pilot as well as to the passengers. There is ample room under the passengers' seat to accommodate a large size suitcase, and there is also a large tool compartment in the back of the pilot's seat.

Landing Chassis

The chassis is the conventional V type. The V's being constructed of steel tubing, spaced at the bottom by two steel tubing tie rods—one in front and rear of the axle. Axle is 1½ inches in diameter, 3/16-inch wall. The upper ends of the chasses are attached to the fuselage by four bolts running parallel with the longerons. Double cables are used, one set fore and aft.

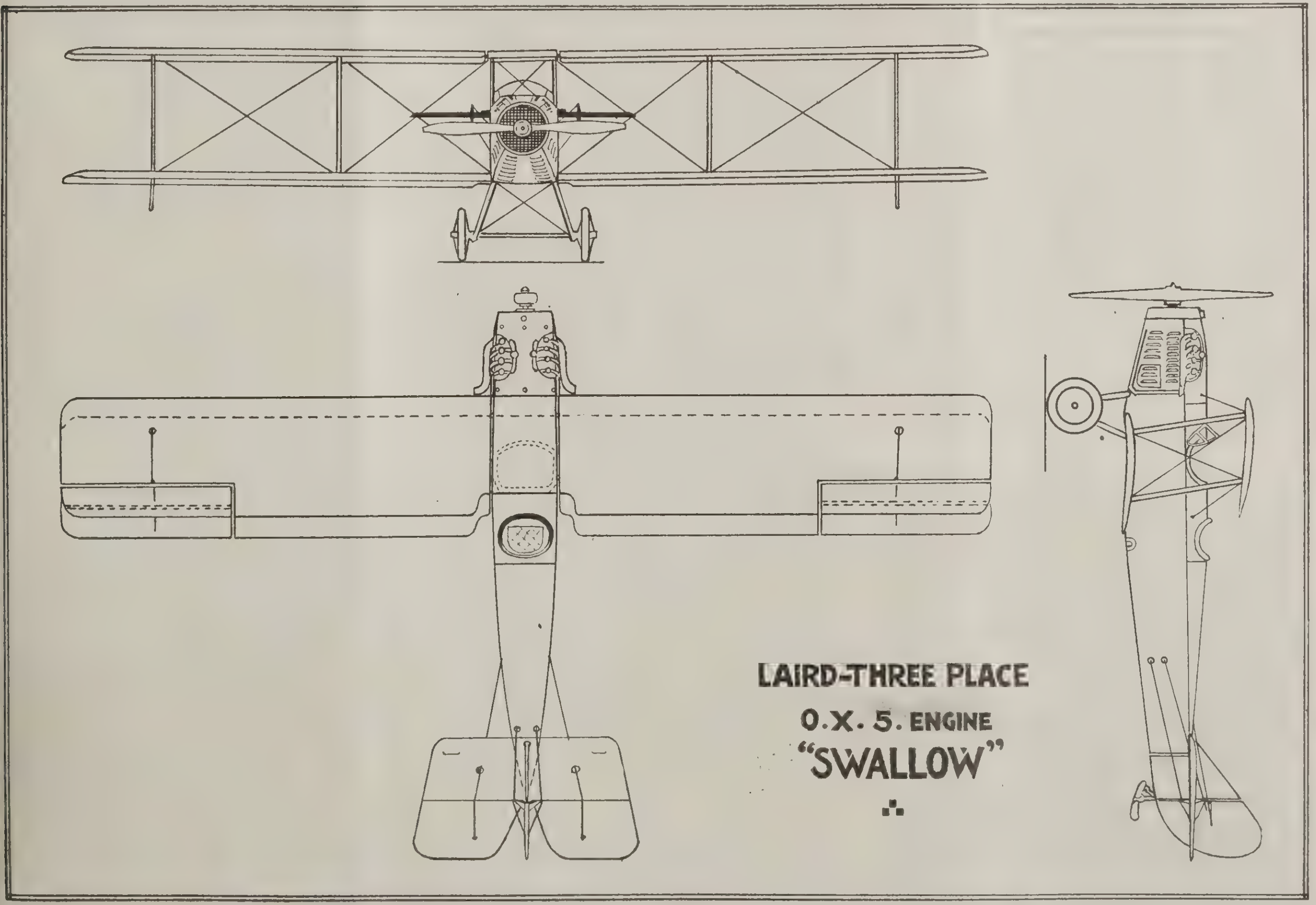
Controls

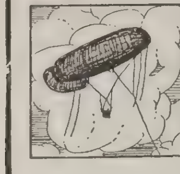
The pilot's cockpit is fitted with the standard stick control and all necessary motor controls. On the dashboard in the pilot's cockpit are mounted altimeter, registering up to 15,000 feet, thermometer, oil gauge, motor thermometer, and magneto cut out switch.

Tail Surfaces

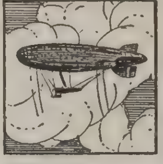
Rudder and elevators are unusually large so that the machine responds quickly to controls at its minimum speed. They are built of steel tubing, all joints being brazed. The vertical

(*Continued on page* 259)





FOREIGN TECHNICAL DIGEST



All-Metal Freight Aeroplane

An account of the International Aero Exhibition gives special prominence to the "Silver Streak" all-metal biplane exhibited by Messrs. Short Brothers of Rochester, which it describes as technically the most interesting exhibit in the building.

This machine, of which the principal dimensions are given in detail, does not contain a single piece of wood or fabric, even the propeller and wing covering being of metal. It is designed as a freight machine, but can be adapted for passenger transport. The wings are composed of steel tube spars and compression members, pierced ribs of sheet duralumin, and covering of sheet aluminum. All the main stresses are taken by the steel members. The fuselage is remarkable for the absence of longerons and internal bracing. Circumferential stiffness is provided by a series of closely spaced duralumin angles bent to a circular or ovoid form. The aluminum cover is applied to these ribs and riveted thereto.

The propeller is also of unique design, consisting of a hollow aluminum casting, with a coverplate of duralumin screwed on to the open rear face. As regards weight, it is demonstrated by a comparison with similar sized machines that the all-metal type does not entail extra weight, while as to cost the Short machine does not compare unfavorably with machines of the wood and fabric type. (*Engineer*, July 16, 1920. 2 cols., 6 figs.)

Transformation of an Aeroplane

The problem considered is that of the modifications required in a certain machine in order to fulfil certain requirements not allowed for in the original design. Rectilinear flight only is considered. The method is the usual one employed in calculating the performance of an aeroplane. Four transformations are examined: (1) Variation of the power plant; (23) increase in the load to be carried; (3) modifications in the supporting surfaces. The fourth calculation is to determine what other variations would be necessary in the machine in order to permit the modification suggested in (1). (Prof. H. Wille, *La Suisse Aérienne*, June 25, 1920. 4 pp., 5 figs.)

Notes on Helicopters

In order to be of any practical value a helicopter machine must be capable of translational motion in addition to its vertical motion.

The solutions of the problem usually suggested are to have one or more airscrews with their axes horizontal to produce the forward motion, or to give the axes of the lifting screws a forward inclination so that their thrust has a horizontal component. In the opinion of the author, both these alternatives are open to a serious objection. He considers a helicopter having two twin-bladed lifting screws and a tractor screw. When the machine has ascended to the required altitude, he controls the lifting screws so that their vertical thrust is equal to the weight of the machine, and then sets into motion the horizontal tractor screw. Since the machine now has a translational motion, the relative velocity with which each blade of the lifting screws meets the air will be periodically varying from a maximum equal to the sum of the forward velocity of the machine and the linear velocity due to rotation, to a minimum equal to the difference of these velocities. The vertical thrust, therefore, will be continually fluctuating, and an oscillation of the machine in the vertical plane will result. (M. de Péshoff, *L'Aérophile*, June 1-15, 1920. 2½ cols., 3 figs.)

Utilization of Venturi Tubes for Power

The experiments described were carried out by the German Experimental Aircraft Station at Adlershof with the object of ascertaining the efficiencies of venturis for the delivery of fuel from one tank to another when working under different conditions.

The following main points were considered:

(1) Relation between pressure drop across venturi and suction developed. The effect of shape of the venturi and the form of the static holes. (2) Efficiency of venturi; ratio of work done in delivery of fuel and available work in air current. (3) Variation of efficiency with height of delivery.

The experiments were carried out in a wind channel, the venturi being used to pump water. The experimental arrangement adopted is very neat. The following conclusions were obtained:

(1) The efficiency of the various types of venturis considered is very low, of the order of 0.1 per cent. (2) The ratio suction development/pressure drop is practically independent of the work done. (3) The best efficiency is obtained at a suction of about ½ to ¾ of the maximum. (4) Both the suction ratio and the efficiency are not affected much by change in wind speed. (5) The efficiency is greater with a slotted throat than with a ring of holes. (6) Best results were obtained with a ratio entrance area/throat area of 4. (7) Venturis can be used on aircraft for the filling of tanks, the simplicity of the plant overcoming its low efficiency. (Robert Gsell, *Zeitschrift für Flugtechnik und Motorluftshiffahrt,* June 15, 1920. 6 cols., 4 dia., 5 tables.)

Helicopters

The author discusses the practicability of flight by helicopters.

He gives the following formular for performance: $H.P. \times d \times \eta = 0.00145 \times \rho^{-½} \times T^{3-2}$, where $H.P.$ is the $H.P.$ of the motor at the height desired, d is the diameter of the propeller, η is the efficiency of the propeller (taken as 0.8), ρ is the density of the air, at the height attained, in slugs/ft^8, and T is the total weight lifted, in lbs. A diagram is given from which, knowing T and the required height, the value of $H.P. \times d \times \eta$ can be read off. Four examples are worked out to show the applications of the formula. (Hermann Borck, *Zeitshcrift für Flugtechnik und Motorluftschiffahrt,* July 31, 1920. 4 cols., 1 fig.)

Aeronautical Nomenclature

With reference to attempts that have been made to establish uniform nomenclature in aerodynamics, the symbols and technical terms used in Austria are here given, together with the units adopted. A comparison is also made between Austrian and German usage. Very useful tables are appended, giving the equivalent symbols and technical terms employed in Austria, Germany, France and England. (R. Katzmyr, *Mitteilungen d. Staatl. Tech. Versuchsamtes,* Vol. I. 1920. 15 pp., 5 figs.)

Notes on Small Sized Aeroplanes

Small sized aeroplanes, as defined by the author, are single-seater machines which weigh fully equipped with fuel not more than the weight of the pilot (75 kg.). They are equipped with engine of about 10 h.p. and should possess a maximum speed of 72 km. hour, with a landing speed of about 25 km. hour. Such machines are urgently required so as to make flying popular and, on account of the low landing speed, safe.

The running costs are low and the machines can be utilied for quite a large number of days in the year. They thus form a very attractive proposition and the author considers that research should be concentrated in this direction. Existing designs, as the tables given show, are of not much help as conditions are so widely different. At the low flying speeds thick wing sections are not necessarily an advantage, these being evidence that the aerodynamic efficiency of such sections increases with the speed. A thin profile is favored on account of its low weight, the necessary wiring being not so deleterious at the low flying speeds considered. The wing surfaces should be carefully treated so as to reduce skin friction to a minimum, the same applies to the body of the machine. Wood construction is favored throughout on account of its resistance on landing and low weight. Special consideration should be given to the wing tips, as with proper shape the drag can be considerably decreased.

The main difficulty will be the provision of a motor of low enough weight. It is thought possible to construct a three-cylinder two-stroke weighing about 2 kg. per h.p., *i. e.*, 20 kg. for the power unit. Double-acting four-cycle engines should also be considered. The essential point in the construction of these small sized aeroplanes is not to have excessive power plants, but rather to obtain success with the minimum h.p. by providing an aerodynamically efficient body and wing construction. The author considers the present method of piling on h.p. to increase performance as radically wrong. Designers should go back to the procedure of the Wright Brothers and construct gliders first and then fit them with the minimum power plant to keep up sustained flight. Gliding as a sport will bring out the finer points of air resistance, and with the experience gained in this matter the construction of the small sized aeroplane, which can be housed in any motor garage and landed in any field or even street, should soon become an accomplished fact. Meanwhile engineers have to go in for small engine research, low weight and a good balance being an essential feature, fuel consumption only secondary. (A. R. Weigh, *Flugsport,* May 26, 1920. 8½ pp., 3 tables.)

NAVAL and MILITARY AERONAUTICS

Head of Kosciusko Fliers Coming Home

Paris.—Colonel P. Cedric Fauntleroy, commander of the famous Kosciusko Aviation Squadron of the Polish army, has arrived here en route to the United States. He was recently promoted to the rank of colonel in the Polish army, and has been authorized by the Polish Ministry of War to recruit pilots and endeavor to buy American aeroplanes for the Polish air service.

Poland has made, and is still making, every effort to obtain the release of Captain Merion Cooper of Jacksonville, Fla., who was captured recently by the Russian Bolsheviki. He is believed to be a prisoner in the hands of the Soviet army near Kiev, and offers have been made to Moscow to exchange any prisoner of any rank for Captain Cooper.

New Educational and Vocational School Opened at Ross Field

A new school for educational and vocational training will be opened at Ross Field. This school will be different from any previously conducted here inasmuch as it offers more thorough and complete courses of training than has been possible heretofore.

The school year will comprise 640 hours, three and a half hours a day, five days a week, allowing two months for a summer vacation. Each man may take one or as many subjects as he wishes and with the successful completion of each course a certificate of proficiency will be issued.

In the vocational line a considerable variety is offered and the list will be added to from time to time. The following vocations are included: Automobile, business, radio, telephone, blacksmithing, music, photography, canvas working, cordage working, tailoring, gas production, carpentry, line work, drafting.

These courses are to be taught by the "Job Sheet Method," which does away with the old-time tiresome theoretical method of teaching and presents the course in a new and practical method by which the student is constantly learning by actual practice. The time that each course will take depends almost entirely on the interest and effort that each one puts into his work.

Air Service Detachment, Aberdeen Proving Ground

First Lieut. Joseph E. Hall, formerly a first lieutenant, Ordance Department, was appointed a first lieutenant Air Service, and is to be stationed here, according to his notice. He was armament officer with the 88th Aero Squadron, overseas.

Sergt. Laurens Claude, a second lieutenant, Air Service, and for the past year an enlisted man in the 258th Heavy Bombardment Squadron, has received notice of his appointment as second lieutenant, Air Service, Regular Army, and is assigned for duty at this station.

The Photographic Section has made a mosaic of the Main Range, Water Range and Plate Range at this station, also the Balloon Field. They are now working on, and well under way, with a mosaic of the whole reservation.

March Field Notes

Seventy-five ships at this school made a total of 567 flights during the past week, covering approximately 30,428 miles in 442 hours 10 minutes. Preliminary instruction consumed 251 hours 20 minutes; advance instruction, 111 hours 10 minutes; forest patrol, 57 hours 10 minutes; test flights, 1 hour 52 minutes, and miscellaneous fights, 20 hours 35 minutes.

Geo. J. Brands, meteorologist of the Signal Corps, has been at March Field during the past week installing apparatus and instructing enlisted men in the care and operation of meteorological instruments. The station installed at this field will be one of the most complete on the Pacific Coast, making it possible to obtain advance information concerning climatic conditions in all parts of Southern California. Brands, upon completion of his work here, will proceed to Camp Lewis Wash.

Air Service Orders

Major W. L. Patterson, A. S., will report to Chief of Staff for duty under the direction of the Director Military Intelligence Division. (Oct. 21, War D.)

Major W. L. Patterson, A. S., is relieved from detail in the Air Service. (Oct. 26, War D.)

Capt. V. Parks, jr., A. S., to Fort Sam Houston, Texas, 8th Corps Area, for duty at Kelly Field. (Oct. 22, War D.)

The following officers of A. S. to Langley Field, Hampton, Va., for a course of instruction at the Field Officers' School of Aerial Tactics: Capt. J. T. McNarney, 1st Lieuts. T. W. Blackburn and A. E. Easterbrook. (Oct. 26, War D.)

First Lieut. C. L. Chennault, A. S., to Houston, Texas, for duty. (Oct. 21, War D.)

The following officers of A. S. to Wilbur Wright Air Service Depot, Fairfield, Ohio, for duty: First Lieut. G. W. Rogers, 2d Lieuts. G. E. Ballard and H. A. Stearns. (Oct. 22, War D.)

The following A. S. officers to March Field, Riverside, Calif., for duty: First Lieut. E. M. Morris, 2d Lieuts. J. G. Taylor and E. H. Wood. (Oct. 23, War D.)

The following A. S. officers to Carlstrom Field, Arcadia, Fla., for duty: First Lieut. W. P. Johnston, 2d Lieuts. C. W. Graybeal and F. D. Lynch. (Oct. 23, War D.)

The following officers of A. S., upon completion of the Alaskan Flying Expedition, will repair to Washington for duty: Capt. St. C. Street and 2d Lieut. C. E. Crumrine. (Oct. 22, War D.)

Officers of A. S. to duty as follows: First Lieut. S. J. Idzorek to United States aeronautical engine plant, Long Island City, N. Y.; 1st Lieut. P. R. Turpin to Wilbur Wright Air Service depot, Fairfield, Ohio; 1st Lieut. W. H. Bleakley to March Field, Riverside, Calif.; 2d Lieut. A. L. Jewett to Fort Sheridan, Ill., for duty in office of air officer; 2d Lieut. C. H. Barrett to aviation general supply depot, Morrison, Va. (Oct. 23, War D.)

Second Lieut. W. L. Boyd, A. S., to Hampton, Va., for duty. (Oct. 22, War D.)

First Lieut. E. J. House, A. S., will report in person to the commanding officer Field Officers' School, Langley Field, Hampton, Va., to pursue course of instruction. (Oct. 26, War D.)

Second Lieut. P. Holland, A. S., to March Field, Riverside, Calif., for duty. (Oct. 25, War D.)

Second Lieut. J. P. Bailey, A. S., to March Field, Riverside, Calif., for duty. (Oct. 25, War D.)

Navy Airships Cruised Nearly 13,000 Miles

Following the extended account in a New York newspaper of Oct. 23 of the cruise of a squadron of six U. S. N. airships of the Atlantic Fleet air force, the Navy news bureau at Washington on Oct. 26 followed with an account of the cruise, which began at Philadelphia, the squadron's home station, on November 12, 1919, continuing until June 28, 1920, the object being to test the seaworthiness of the ships. The squadron was in command of Lieut. Comdr. Bruce G. Leighton, U. S. N., with Lieut. J. H. Hawkins, U. S. N. R. F., second in command. It first cruised down the Atlantic coast to Hampton Roads, and from there to New York city, where the squadron was reinforced by the U. S. S. Sandpiper, which was sent ahead of the squadron, towing a lighter, to take care of the ships on their arrival at the different ports of call on the itinerary. The U. S. S. Shawmut accompanied the U. S. S. Sandpiper as a tender for the squadron. The ports of call included Charleston, S. C.; Savannah, Ga.; Key West, Pensacola, Tampa, Fla.; Guantanamo, Cuba; Cape Haitien, Mole St. Nicholas, Samana Bay, Haiti; Sanchez, San Domingo; San Juan, Ponce and Miraflores, Porto Rico; St. Thomas, Virgin Islands; Kingston, Jamaica; Nuevitas, Cuba; Turtle Harbor, Fernandina, Southport, Fla.; St. Mary's, Ga.; thence to Hampton Roads and back to Philadelphia. During the entire trip the squadron sailed under its own power and covered a distance of 12,731 nautical miles.

16 Seaplanes to Cooperate with Atlantic-Pacific Fleet—Maneuvers on Chilean Coast

Thirty-eight warships and a fleet of the 16 F-5-L type seaplanes will comprise the Pacific Fleet that will sail January 5 for the Central and South American cruise. Interest in the batle maneuvers is intensified by the fact that it was off the coast of Chile that the first sea battle between the German and British patrol squadrons occurred shortly after the outbreak of the war.

Already the fleet air men are looking forward to the time when they will sail south. The best athletes from the Pacific will contest honors with the Atlantic. Christmas holidays will be spent by the fleet in their respective ports, after which they will be in readiness to sail south. It is expected that there will be a number of NC planes received on the North Island Station soon, some of which will possibly make the trip south for the joint operations of the fleets.

FOREIGN NEWS

To Timbuctoo by Air

It will soon be a comparatively easy matter to get to Timbuctoo, as a French syndicate has been formed with the object of organizing aerial services in North Africa. Three lines are proposed, the main objective being the Golf of Guinea and starting from Oran or Algiers, the route would be either Bourem-Ouaghadougon-Lommé or Sikasso-Bingerville. The second line, the Senegal-Tschad service, will start from Dakar and fly *via* Bamako-Timbuctoo and Zinder, with a probable extension to Brazzaville. The third line, the Tunis-Senegal service, will start from Tunis and skirt the Mediterranean coast *via* Algiers, Oran and Casablanca, and along the Atlantic coast to Dakar. Later on a dirigible service may be started from Orly, calling at Marseilles and then proceeding to Algiers and Morocco.

Aviation in China

Very interesting was the report of aviation progress and prospects in the doings at the Peking Syndicate, Ltd., general meeting the other day. The Chairman said that at the last meeting he announced that the company had been appointed agents for several well-known firms, such as Handley Page, Ltd., Marconi Co. and Siemens. Since then they had sold to the Chinese Government six large Handley Page machines. They had also placed orders since then for a few smaller machines for training purposes. An aviation school had been started a few miles outside Peking, with Handley Page representatives in charge. The Chinese, he said, took very kindly to aviation, and would make excellent pilots. Commercial aviation in China was feasible. The greatest drawback to China at present was lack of communication, and anything that tended to improve that position was of the greatest assistance to her. In countries like England and America, where the roads and railways were good and allowed of rapid communication, commercial aviation had to face serious competition, but in China, where distances were great and roads and railways practically did not exist, and even on the inadequate railway system the fastest train only averaged 25 m.p.h., aviation had more than a chance. In his opinion, there was a big field there for British manufacturers, but there was serious competition to be faced from other nations who recognized the position, and while British manufacturers were being cramped by our own authorities on the ground that the machines wanted by the Chinese Government were for military use, and, therefore, under the agreement between the Powers such material must not be supplied, other nations took a less strict view, and, in his opinion, very rightly so. Aeroplanes without guns were no more war material than horses which might be used for cavalry or other purposes. Their use for passenger and mail carrying was proved by the company in May last, when they made the first passenger and mail trip from Peking to Tientsin and back, and had the honor of carrying His Majesty's Minister, Sir Beilby Alston, the British Commercial Attaché, Mr. Archibald Rose, and some leading business men in Peking, fifteen passengers in all. Sir Beilby was the first Minister to fly in China, and well deserved all the credit they could give him for his enterprise.

Gift of Aeroplanes to India

Of the 100 aeroplanes which have been presented to India by the Imperial Government, a certain number have been given to local governments, others are to be presented to ruling princes, and 20 will be retained for the Air Force in India. It is proposed to offer the remainedr to aero clubs, ex-R.A.F. officers resident in India, or to companies prepared to establish aviation schools. The machines will be handed over free of charge at Karachi, on condition that they are used for purposes of demonstration and instruction, and are not sold to third parties.

An Air Conference at Versailles

Air questions which have not yet been settled by the Peace Treaty will be dealt with at Versailles during the next few days by a Commission of 28 Allied officers.

Italian Small-Aeroplane Contest Postponed

In view of the political situation in Italy preventing the entrants from having their machines ready in time, it has been decided to postpone the international competition for the Mapelli Cup until November 4. This cup has been offered by Mr. Luigi Mapelli for an annual competition for aircraft "having a wing-spread of not more than 6 metres over all, and driven by engines of total stroke-volume up to 4,585 c.mil. inclusive." The competition is a speed one, and each succeeding race is to be twice the distance of the preceding one. For this year the course selected is Taliedo-Arcore-Ponte S. Petro-Erba-Malpensa-Cameri-Sesto S. Giovanni-Taliedo, a distance of 182 kiloms. At each of the places named the competitors will have to come down for three minutes, and the machine which completes the course in the shortest time will win the cup.

Aeroplane Ordinance

The Hague.—So many continental aeroplane lines now cross Holland that some of the Dutch cities have adopted ordinances to prevent the air liners from flying so low as to become a source of danger. An ordinance adopted by this city requires the air pilots to keep more than 8000 feet above the level of the city.

Exhibition of Aviation Material

The Aircraft Disposal Company, Ltd., will have comprehensive exhibits of aeroplane parts and fittings of every description at the International Motor Exhibitions at Olympia and White City, which will be open from November 4th to 13th next, and also at the Cycle and Motor Cycle Show, which takes place at Olympia from November 29th to December 4th. Motorists will find a complete selection of magneto spares in convenient quantities for all types of magnetos and various instruments suitable for attachment to motor cars and cycles, such as revolution counters, gradient meters for hill tests, compasses for night driving when touring, air speed indicators for indicating wind pressure in substitution for gear-driven devices, etc. Invitations are also being issued by the Aircraft Disposal Company to view the sample accessory exhibition at Regent House, Kingsway, W. C., and cars will be available for visitors who desire to view the large stocks of aero engines and other aviation material at Waddon and other depots.

German Aerodrome Buildings at Gotha

It is stated that after protracted discussions with the representatives of the German Government, the Inter-Allied Commission has now agreed that two of the extensive buildings at the aerodrome at Gothe are to be allowed to remain on the condition that they are converted into factory premises. The Germans desired to retain the buildings for civil aviation.

The "L.113" Arrives at Maubeuge

France has now received the second Zeppelin awarded under the Treaty of Versailles, the "L.113" arriving at Maubeuge on the morning of October 9th. The mist was so thick when the airship arrived at 6 a. m. it was decided to postpone the actual landing for three hours. Capt. Huon de Kermadu was in command, and there were 17 German officers and men on board.

The Sopwith Company

At a meeting of creditors of the Sopwith Aviation and Engineering Co, Ltd., it was pointed out that the company was formed in 1913 with a nominal capital of £26,000. Up to a year ago the company did so well that reserves of £900,000 were accumulated. An approximate statement has been prepared which shows assets to a value of £862,630 and liabilities at £583,510. It seems likely that a large amount of the latter, which is at the moment E. P. D., may be recovered.

The Buc Meet

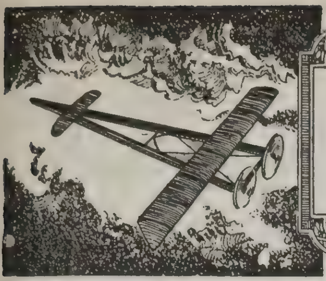
The Buc aviation meeting, which took place during the week of October 4th to 10th, was the oustanding French aviation success of the year and seems to rank second in popularity only to the R. A. F. pageant at Hendon. The Buc-Brussels and Buc-London races were the events of the meeting.

M. Thierry, on a Breguet, won the "Concourse of dexterity and address." The world's speed record was broken by de Romanet, on a Spad. He attained a speed of 292 km. 680 m. per hour. Sadi-Lecointe subsequently beat this performance by 1 km. per hour, but as the F. A. I. rules state that a speed record has to be exceeded by 4 km.p.h. to be homologated, de Romanet's record stands. If Sadi had started first he would have held the record.

Flight with Locked Controls

The French aviator Fronval is reported to have made a flight at Villacoublay on a Morane-Saulnier monoplane of 80 h.p. with the "joy stick" tied to prevent its being used. He ascended, flew several circuits and landed without using any control, except steering.

An interesting line-up of machines at the Aviation Meet at Buc, France



ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

The Long Distance Racing Model

THE accompanying drawing shows a long distance type of racing model such as aeromodelists use for hand-launched long distance work, and is a good model for use in the coming contests.

The best models of to-day have a wing of the shape shown in the drawing, and this is the most efficient from an aerodynamic standpoint.

A model of this kind will give pleasure to the builder besides winning prizes in model aeroplane contests, and the sight of one of these long distance models high in the air is truly an interesting sight, and the exercise derived from following these models for long distances is worth the time spent in building one.

While the construction is simple, a good many points must be taken into consideration when building or designing a model of this kind. One of the principal points is to have the model clean cut so it can pass through the air easily as the motor is cut down until the minimum of power needed to propel the model through the air is reached. This is accomplished by covering the wings top and bottom with some sort of thin skin, fine silk or tissue paper, doped with a solution to shrink the covering and also fill the pores.

The proper method of determining the correct amount of rubber to use is to put on a large amount of rubber and gradually cut it down until the minimum is reached that the model will fly with. The correct amount will just keep the model in the air until the rubber winds out completely. Flat rubber about 3/16″ wide and 1/32″ thick is the best for models.

Although the model shown is for hand-launched flights, a simple landing chassis can be designed to attach to the "A" frame and for use in R.O.G. (rising off ground) contests.

To construct the model the frame should be made first. The main spars are made of spruce 5/16″ x 3/16″ and 40¼″ long. The spars are joined together at one end to form the apex of the frame. It is necessary to taper the spars slightly and bind with thread and glue. The other ends of the spars are notched and a strip of streamline spruce 12¼″ long and ⅜″ x ⅛″ thick is fastened with thread and glue also. To strengthen the frame, a cross piece is fastened to the spars about midway and a piece of steel wire is bent to a half circle with loops at each end and fastened to the spars. This wire acts as a brace and a terminal for the bracing wires as well. The bracing wire is the thinnest of steel piano wire, and is fastened to the loops, pulled taut as possible and fastened at a point where the rear spar and the main spars are fastened together. A frame of this shape is called an "A" frame on account of its shape.

Bearings for the propellers are fastened to the ends of the rear spar. These bearings are for allowing the propeller shaft to turn without friction, and are made of 1/32″ I. D. copper tubing. The propeller shaft on steel piano wire just small enough to pass through the hole in the tubing and still turn freely. These bearings can be made in different styles, as shown in the drawing to the right.

A piece of steel wire is bent to a "V" shape, and the ends bent back to form a hook. This is used at the apex of the frame to fasten the wires to, and is also bound with thread and glue.

The propellers are made to the shape shown at the bottom of the drawing and should be 12″ long and are carved out of a block of white pine 1″ thick. If the model builder does not think himself capable of making the propellers correctly he can purchase them from any model supply house, as well as bearings, wood, bamboo, etc.

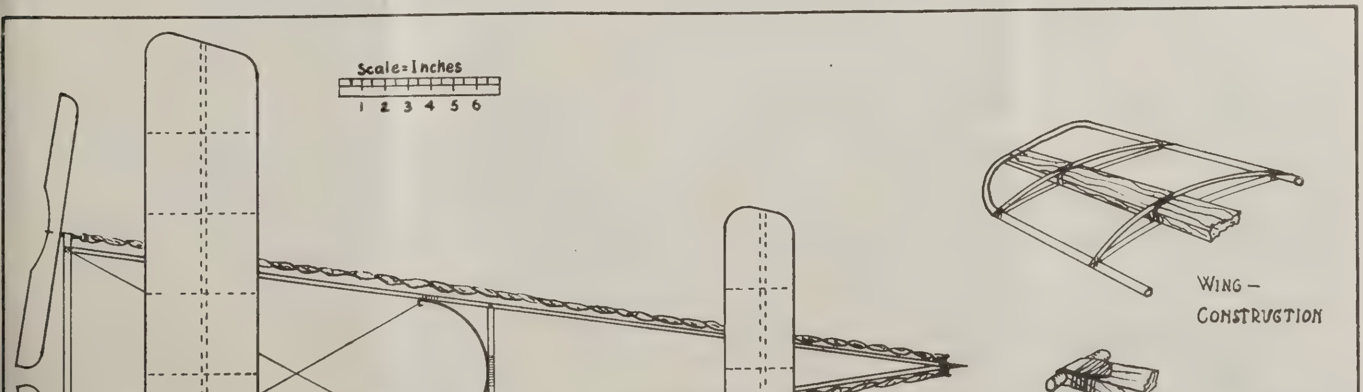
The wings are made up of bamboo and spruce, the spruce piece running through as a sort of back-bone. The spar is 3/32″ x 1/16″ and the ribs, trailing edge and entering edges are bamboo.

The construction of the wing is clearly shown at the right of the drawing. All dimensions can be ascertained by using the scale at the top of the drawing.

The wings should be covered with what is known as "Gold Beaters Skin." This can be purchased at model supply houses or from wholesale druggists. The skin is applied by heating over a fire and then fastened to the frame of the wings with Amberoid glue and doping with a mixture of Ambroid glue diluted with acetone and banana oil.

When covering the wings cover one side then dope it, after which the other side can be applied and doped.

If constructed properly this model will make flights of 3,000 feet and over. One thing must be remembered and that is, the ribs of the wings as well as the edges must be only 1/16″ round bamboo, if made thicker the model will be too heavy.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

"Flying Thoughts" of an Onlooker

I wonder just how it does feel 'way up there
A thousand or more feet suspended in air?
Do the troubles of Life fall away or remain
And just what effect is produced on the brain?
Does the lightness and buoyancy of ether make clear
All that puzzles and annoys in this hemisphere?
Just what is the feeling if you cannot restrain
The thought of the "drop" with the accompanying pain?
Are you wan, are you timid, do you feel sad or gay
Is reason suspended, would you let happen what may?
Do you look up or down or reflect on your sins
And sense that your life could be bought for two pins?
Or does the perspective of Life and its ways
Make all seem bizarre—appear small to your gaze?
Does the cool quiet influence of cloud and vast space
Sink down in your consciousness and deepen apace?
Would you wish to float on without ties and carefree,
And prolong these conditions indefinitely?
Looking up from the ground to the machine in the air
One ponders if e'en by chance they'd be there.
And whether or no they'd have courage to start
In that huge "Dragon Fly" or would they lose heart?
So far, I have never been put to the test
But I hear the sensation is "odd" at its best.

I. P. Priest.

A demure young lady stood in front of one of the aeroplanes at the aero show and wondered. She gazed at it in admiration, and at last summoning together all her courage, she spoke to a man standing by.

"Do those wings move like those of a bird?" she asked.

The man then explained to her that such was not the case, and tried to make it clear that the wings simply supported the aeroplane, while it was the propeller that sent it through the air.

"Well," she said, I don't doubt that you are telling the truth, but I have not yet arrived at the state of mind where I can believe it!"

It's Your Move, Bill"

Couldn't Quite Figure it Out

A representative of a New York manufacturer recently called at a large aeroplane factory, and while waiting for his appointment happened to engage in conversation a workman who was working on the body of a new machine.

"Ever made a flight?" he asked the man.

"Nope."

"Why, how long have you been in the factory?"

"Goin' on four years."

"You mean to tell me that after working here four years, and seeing all this flying going on around you that you have never been up?"

"Say, mister," returned the workman, "I've been *making* these machines for four years, and I'm hanged if I know even now why they ever get off the ground!"

Limericks

"Some 'bus" was the old Petrodactyl,
For flying it quite had the knack, till
    It first heard its name called,
    When it side-slipped and stalled.
Archæologists are on its track still.

! ! !

Said a pupil unto his instructor,
"I want to become a constructor."
    Said the other, "My boy,
    I don't wish to annoy,
What's more in your line is destructor."

! ! !

A certain young pilot of Pinner,
Got gradually thinner and thinner,
    Till at last (it was rummy)
    There was not enough "tummy"
To effectually streamline his dinner.

Special Correspondence

B. O. O. B. (Phila.):

No, it does not matter having the c. g. in the gasoline tank, so long as a reliable filter is used.

Non-Stop (Springfield):

Yes, the war is still going on, and you are the 9849th correspondent who has solved the problem of perpetual motion.

Ripe (Flatbush):

To convert monoplane figures to biplane figures, use the following formula: $C_2H_5OH + H_2O$.

If the stagger is too pronounced, try more water with it.

Quantity, Not Quality

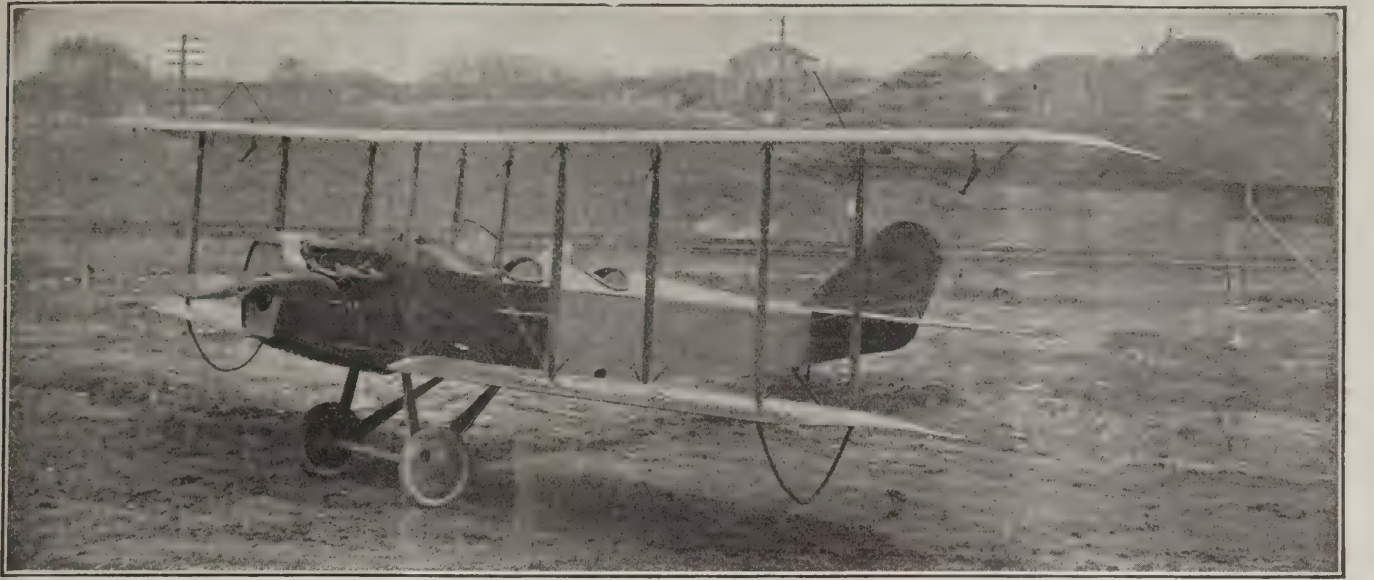
Mechanic—"I want a Webster's largest size dictionary."

Librarian—"We have none in now except the small ones."

Mechanic—"Naw, this is important; there's a leg missing on my dresser."

Aero—What's the matter with your eye?

Naut—Bill planted a blow there and it grew up and blossomed.



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Northwest Aircraft Corporation, Newell, S. D., for Western South Dakota.
Erick Aviation Company, Erick, Okla., for Western Oklahoma and Pan Handle.

(Continued from page 253)

and horizontal stabilizers are built up similar to the wings, steel tubing being used as entering edge.

Engine

It is powered with the Curtiss OX-5 engine, standard equipment. Its known reliability as well as economy in upkeep make it thoroughly adaptable for a commercial plane.

Specifications

Span:	
Upper wing	36 feet
Lower wing	36 feet
Wing chord, both planes	58 inches
Gap between wings	58 inches
Overall length	23 feet, 4 in.
Overall height	8 feet, 8 in.
Stagger	10 inches
Wing Areas:	
Upper	168 square feet
Lower	156 square feet
Total with ailerons	324 square feet
Weight:	
Empty	1,075 lbs.
Fully loaded	1,750 lbs.
Useful load	675 lbs.
Fuel weight	195 lbs.
Range at full speed	255 miles

Performances

The performances below are from the actual test flights, the ground level of the starting point being 1,400 feet above sea level:

Maximum speed	86 M.P.H.
Minimum and landing speed	38 M.P.H.
Climb to 4,000 feet (pilot, two passengers and full tanks),	10 minutes
Climb to 3,000 feet (pilot alone)	4½ min.
Climb to 8,000 feet (pilot alone)	17 min.
Climb to 10,000 feet (pilot alone)	23 min.
Climb to 15,000 feet (pilot alone)	1 hr.
Ceiling 17,000 feet.	
Loading:	
Per H.P.	19.44 lbs.
Per square foot	5.40 lbs.

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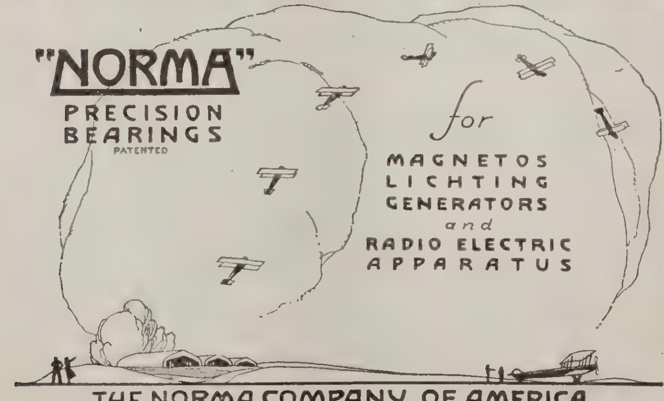

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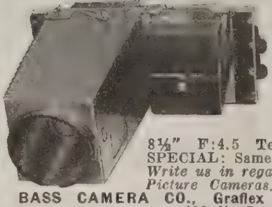

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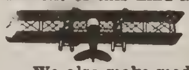

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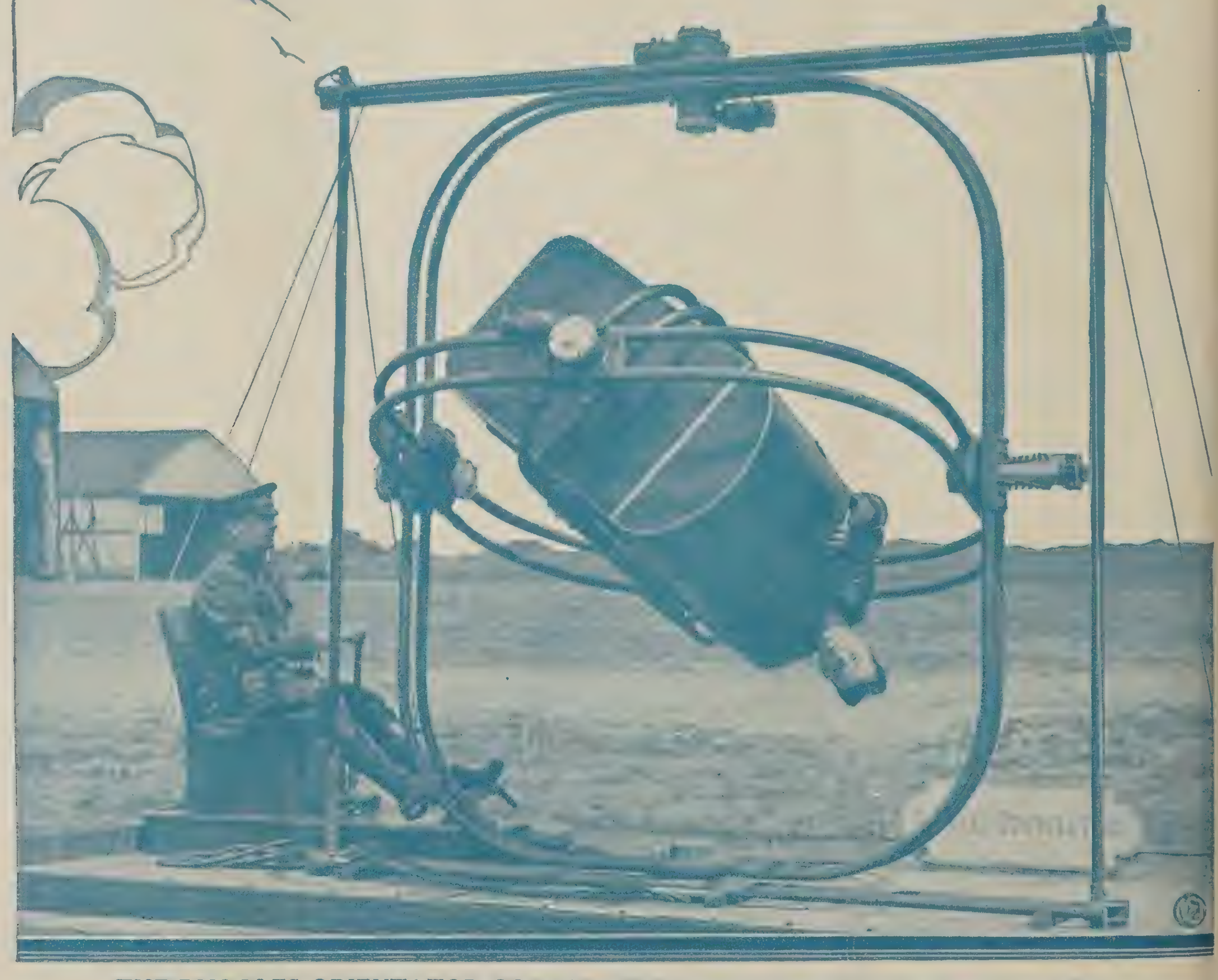

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AIRCRAFT CONSTRUCTION MUST BE ENCOURAGED

CONGRESS will meet on the sixth of December and will tackle a burdensome program of national and international affairs, and our every effort must be made to focus public attention on the supreme importance of developing and adopting a constructive aircraft construction policy, a program which will permit the extension and expansion of an aeronautic industry worthy of the United States.

There should be no delay on the part of the Manufacturers' Aircraft Association, the organization that is best fitted to deal with the situation, in calling an air convention, at which every authority in the Army, Navy, Post Office and civilian aeronautic circles should have an opportunity of discussing the present national situation and offering suggestions for its remedy.

The Army has adopted a wise policy during the last year in distributing its orders among as many companies as had the necessary technical personnel and the equipment to handle such orders. But such a policy, having in mind the limited appropriations, is but a "hand-to-mouth" solution, for there has not been sufficient construction required to assure any one company of a clear profit from this source of business.

It is essential to our national welfare that the technical experts and construction facilities should, in large part, be retained, and now is the time to demonstrate to the public at large that there is a solution to the problem, feasible and beneficial.

While some way may be found of offering encouragement to operating companies by government departments, as the Post Office has done, it is pre-eminently important that every encouragement should be offered the designer and constructor, otherwise technical development must necessarily stagnate, and we shall, very rapidly, as a nation, take an inferior position in this important matter.

There has been considerable talk of "subsidies" for the aircraft industry, but it seems to us that the best "subsidy" that could be offered would be an Army, Navy and Post Office aerial program that would assure the manufacturer of a sufficient volume of business to guarantee his not taking a loss and the manufacturer would see to it that he would "sell aeronautics" to the civil population to secure a fair working profit.

There has been a tremendous number of "flying hours" and "air miles" travelled during the past summer, which is indicative of the possibilities of next summer, but which is not in any measure a barometer of the business done by the industry, for here, as in all other countries, the market has been glutted with war machines adapted to peace-time uses.

A sound policy of customs regulations on aircraft should be asked of the next Congress; a policy which would secure the selling of foreign equipment in the United States on a fairly competitive basis. And, furthermore, there should be as definite a standard of airworthiness and reliability maintained as the present stage of the science will permit.

It therefore behooves the Manufacturers' Aircraft Association to get busy, get all shades of aeronautic opinion together in a national air conference, educate public opinion by presenting to the press a comprehensive daily digest of the discussions, so that our legislative fathers may be aware of our national aeronautic needs of the moment and of the future.

Speed a Necessity

THE third successive victory for France in the Gordon Bennett Race, and the consequent termination of this historic event, has created diversified discussion in American aeronautic circles. Should there be an international trophy presented to take the place of the Gordon Bennett, or should a prize be offered for a plane with greater utility or commercial usefulness?

From the very character of the aeroplane we feel that a competition, in which speed alone is the desired element, should be maintained, primarily for its reactive influences and benefits to military aviation. It seems apparent that, with what is now more or less regarded as standard construction, we have about attained the maximum speed, and only by the introduction of such features as differentiated the Dayton-Wright entry from the other machines in the race may we expect to get greatly increased speeds. By keeping speed in the foreground we will encourage the most valuable characteristic of all aircraft, and the other features of safety and utility will come automatically, for the simple reason that mere speed freaks will not bring profits to the manufacturer.

The Value of Air Power

THE Post Office Department is adopting a broad and sane policy in taking advantage of civilian co-operation in the handling of the aerial mail, and it is to be hoped that the contracts which have been awarded to the Aeromarine West Indies Airways Co. and the Lawson Airline Co. will be followed by others.

The supremacy in air power in the future will go to that nation whose mercantile air fleet, capable as to *personnel,* is in the forefront in point of numbers and application, for in most part its *personnel,* and to a considerable extent its equipment, can be turned in a very brief time into defense units.

The triumph of the U. S. Aerial Mails, which has brought forth encomiums from all foreign nations, is an excellent asset, and a still greater utilization of the civilian organizations capable of undertaking mail contracts will be a further step in the right direction.

THE NEWS OF THE WEEK

Bennett Cup Winner Will Try New Record

Sadi Leconte, winner of the Gordon Bennett cup race last month, intends to contest the new speed record made by Capt. de Romanet, another famous French flyer, in a Spad-Hispano aeroplane over a measured kilometer at the Buc flying field. Capt. de Romanet officially registered a speed of 309 kilometers an hour (195.5 miles), which is seven kilometers an hour more than M. Leconte made. M. Leconte said that in his next speed trial he will fly 320 kilometers an hour.

The French press is beginning to fear a serious accident if the speed ambition which is swaying French aviation enthusiasts at the present time is not checked.

Capt. de Romanet's speed record has been formally accepted by observers of the French Aero Club and sent by wireless to the associated aero clubs.

Flew Over Europe On Business Trip

A flight of 3,250 miles for business is a new record made by an English business man. He is R. Wright, a Manchester engineer, who returned to London recently from a tour of Central Europe in a Handley Page machine. The return trip was made from Jassy, 215 miles beyond Bucharest, by way of Strasburg. From Strasburg a record non-stop flight was made to London, a distance of 420 miles, in 3 hours and 50 minutes. From Jassy to the hangar at Cricklewood the distance is 1,635 miles.

New International Trophy

Lugui Mapelli has offered, through the Aero Club of Italy, a Trophy valued at 50,000 lira with which will go a cash prize of 3,000 lira, for annual competition. The contest will be open to aeroplanes having a wing spread of not more than 6 meters over all and driven by engines of a total stroke volume up to 4585 centiliters.

The first competition in the series took place on November 7, but the results have not yet become known.

Tenders for Canadian Aircraft

The Air Board of Canada recently sent a memorandum to the leading aircraft manufacturers of Great Britain calling for tenders on some special types of machines which are required for next year's operations of the Air Board. These aircraft will mainly be used for photographic exploration and forest protection and the following types are provided for in the memorandum:— (1) single-engined aeroplane, (2) single-engined float seaplane, (3) single-engined flying boat, and (4) twin-engined aeroplane.

The Air Board intends to purchase one machine of each type after exhaustive trials to be conducted in Canada, to standardize the types found most suitable and to then order them in quantities. Delivery of machines will be required on or before March 1, 1921.

For exploration work machines will have to be capable of making long flights away from their base, because the country is rough and uncultivated, while airports are few and far between. For this reason, also, very reliable engines will be required for these aircraft.

As to forest protection, the memorandum emphasizes that the only months free from snow and ice in the northern parts of Canada are April to November. Therefore, if aircraft are to operate all the year 'round, provision must be made on all aircraft to land on snow and ice. One of the greatest problems in this connection is the fact that for a time in the spring and the fall it will be difficult to find either open water for seaplanes to land upon or yet ice sufficiently strong to bear the weight of the machine at rest.

Women's Flying School

The first flying school for women has been opened in England, where an aspirant may learn all the ins and outs of aviation for a fee of $500.

New Landing Record

The French aviator, Fronval, has established a world record for landing at a given spot when he ascended to a height of 1,000 meters and came down within nine feet of the spot indicated. The actual measurement was 2.60 meters. Fronval holds the record for looping-the-loop.

Volara R. Nelson, the first woman to secure an expert pilot's license in America, with her Avro, in which she is doing exhibition work in the Middle West

Ship Refuses to Stop for Air Passenger

Christian J. Volf, Jr., president of Volf & Company, manufacturers of hardware in Philadelphia, was to have sailed for England on the Cunard Line Steamship Mauretania. There was a difference in the time of the steamship's sailing given him by officers of the company in Philadelphia, Mr. Volf says, and the actual time the vessel left, with the result that he was fifteen minutes late.

He arranged with the Aero Limited to take him to the vessel. Mr. Volf boarded a plane at Eighty-fourth Street and the Hudson River half an hour later and overtook the steamship at Sandy Hook, but Capt. A. H. Rostron of the Mauretania refused to stop, he says, because the water was too rough.

Flies at 70 to Aid Girl Scouts

Mineola—Mrs. Juliette Low, 70 years old, said to be the founder of the Girl Scout Movement in this country, left Roosevelt Field in a Farman biplane November 4, and flew over New York to advertise the opening Saturday of the campaign to raise $1,033,400 for the Girl Scouts in New York. She was accompanied by Lawrence Driggs.

The plane flew over Central Park at a height of 3,000 feet, down Fifth Avenue and over the scout headquarters at Lexington Avenue and Thirty-ninth Street. Campaign literature was dropped from the plane by Mrs. Low during the flight.

French Aviator Flies 193 Miles An Hour

Paris—A new world speed record over one kilometer was made November 4 at the Buc Aerodrome, near Paris, by Bernard de Romanet, with a Spad-Hispano machine. The official speed, controlled by chronometers and officials of the Aero Club over a measured kilometer, was 309 kilometers, 12 meters per hour (about 193 miles), the distance being covered in 11 65-100 seconds.

This record beats the one made by Sadi Lecointe on October 20, when he passed the 300 kilometer per hour mark for the first time.

During one of his journeys over a measured distance which was unofficially timed de Romanet beat his official record by a big margin. This speed was timed at 11 1-5 seconds, giving an average of 321 kilometers, 428 meters per hour.

When the record was made there was considerable mist, which de Romanet declared afterward somewhat bothered him.

Since he flew in the Gordon Bennett race he had modified his machine and now sits entirely hidden in the fuselage, with only lateral vision.

Greensboro, N. C., to New York in Six Hours

Pilot Charles W. Meyers of East Orange, N. J., recently made a particularly creditable flight from Greensboro, N. C. to New York, a distance of slightly over 500 miles in 6 hours and 20 minutes flying time. He used a Canadian Curtiss equipped with an OX-5 motor and carried as a passenger John Davis of Greensboro.

During the past season Mr. Meyers has used the machine flying in Alabama, Georgia, South Carolina and North Carolina, advertising the Chero-Cola Bottling Company who are enthusiastic over the interest aroused by this new method of advertising.

Pioneer Work in Colombia

Knox Martin, one of the pioneer American pilots who has been flying in South America for the last year, was recently in New York to purchase aeronautic equipment for the Colombian Government.

Martin was in the Aviation Section of the United States Marine Corps and when he received his discharge in March, 1919, he purchased a Curtiss JN and travelled to Colombia.

The first six months of his stay in that country was devoted to exhibition flying, passenger carrying and mail work, and he found the Colombians enthusiastic over the possibilities of aeronautics in their country. The geographical character of the country confined Mr. Martin to the coast towns for a considerable time but the influential citizens of the interior were so insistent in their demand for his exhibitions in the interior, that he ultimately decided to make a tour of the entire country.

He spent considerable time in Bogota the capital of the country which is almost 10,000 feet above sea level. Here he had to confine himself to exhibition flying, it being physically impossible to accommodate a passenger and ascend at this high level.

When Mr. Martin returns to Bogota he will confer with the leading citizens and give them information which he has secured on this recent visit which will probably result in the organizing of an air line from Bogota to the nearest seaport town, a distance of 500 miles which takes from seven to ten days to traverse using the present means available.

Colombia is ready for aerial mail service and American manufacturers can secure from Mr. Martin important information which should lead to their securing the orders for whatever machines will be put into service.

Zeppelins Anxious to Send Ships Here

In a recent interview secured by the Berlin correspondent of the Chicago Tribune, Dr. Hugh Eckener, a director of the Zeppelin Company, explained the airship situation in Germany. Most important was his statement that the Zeppelin set aside for America was now allotted to Italy, inasmuch as the United States had failed to join the Reparations Commission. He also declared that the American army and navy had entered into negotiations for aircraft, but they fell through for the same reason. They now hope to have the opportunity to build for the United States.

Furthermore, he declared that two American firms sent representatives to Germany last year but no deal was consummated. He is hopeful that peace will be followed by the resumption of negotiations which will eventually lead to making the rumored Spain-New York-Chicago air line, the first link in the plan to circle the world, a reality.

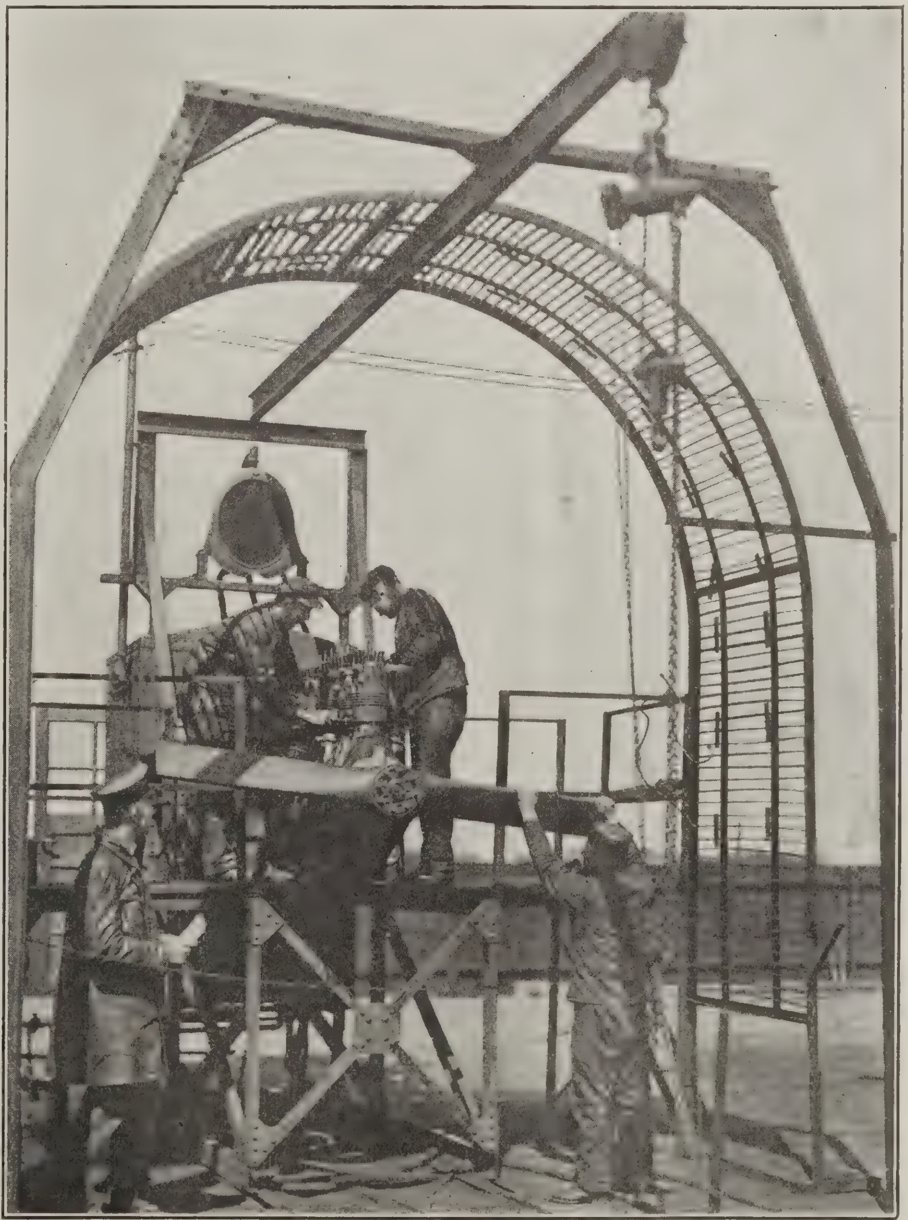
"Work on the first Zeppelin intended for the American trip was suspended in January, by orders of the Allied Mission," declared Dr. Eckner. "But it is possible to complete it within eight months if we receive permission to go ahead with construction. This ship will have a gas capacity of 100,000 cubic meters, will be the largest airship in the world, and will be capable of making three Atlantic crossings without stopping. Furthermore, we are not idle, but are planning bigger, better craft, inasmuch as war-time experiences have proved that Zeppelines are the fastest, safest and best means of transportation.

"According to the Treaty of Versailles we were not to be permitted to resume civilian operations for six months, but when the time limit elapsed we were ordered not to recommence. Various reasons for this order were given, but we have suspicions that it was the hope of certain of the Allies to prevent Germany building until they had established commercial air lines and made competition impossible.

"Today all the Zeppelins, except Japan's, have been delivered. Zeppelin 113, which was intended for America, was given to Italy. The one intended for Japan will not be shipped intact, because Japanese officers who were here studying construction ordered us to ship only the small parts, which we are doing.

"We have two civilian ships left, one named the North Star and the other the Bodensee, which the Entente have prevented us from flying. Today we received word from General Masterman, the Briton heading the Reparations Commission, saying that we could fly these ships. We replied, asking two guarantees, that the ships would not be confiscated and that the sheds and wharfs would be left intact. When these guarantees are given we shall open a line between Stockholm, Berlin and a point in Switzerland. We also have reasons to believe that the Entente's order for the destruction of the sheds and wharfs will be rescinded. I am hopeful that when America declares peace and has members on the Reparations Commission she will confirm the order, for unless we have such wharfage we cannot operate. When Americans are on the Reparations Committee we are sure that United States interests will take up the plan for formation of an international syndicate establishing a line between Europe and America.

"We are also prepared to put together a Zeppeline from the remainder of the three wrecked by our soldiers during armistice week. We will show the American military authorities everything we have shown the Entente and offer to build a craft for you. There is no truth in the reported statement by Sir Trevor Dawson to the British Air Congress that we have decided to remove our factories to America to evade the treaty."



A German aero engine test stand which has some excellent features

The AIRCRAFT TRADE REVIEW

N. E. J.

Interesting Aeronautic Statistics

In a recent interview, in which he discussed aerial regulation, Albert H. Flint, president of the Manufacturers Aircraft Association, who is probably in as close touch with American aviation as any man in the United States, had interesting figures to prove the importance of the problem.

"There are in the United States to-day one thousand privately owned aircraft," he said. "More than 100 companies operate aeroplanes in passenger carrying, mostly short flights in the vicinity of air ports, but not a few between cities. In approximately six months' time, according to fragmentary reports being received, 80,000 persons have been carried and 1,000,000 miles flown. Such accidents as have occurred have been traced either to carelessness in operation and inspection or to the lack of properly regulated terminals. This condition can only be remedied by the recognition on the part of the United States Government of its responsibility.

"Cognizance should be taken of the fact that there already exists a considerable air traffic overland between the United States and Canada and Mexico and a growing air traffic over sea to the West Indies. Consequently the aerial system should be capable of international application. The preparation of such legislation requires cooperation with civilian activities by the twenty or more government agencies now interested in aeronautics. The enforcement of the act, its interpretation and national application should unquestionably be placed with some central responsible federal organization."

Titanine, Inc., Reorganizes

Titanine, Inc., with a factory at Union, N. J., has recently reorganized their production department to a point where they can make immediate shipment of dopes, both clear and pigmented protective, the latter in a range of sixteen colors. Orders are shipped the day received.

Plans are now being developed to establish agencies throughout the United States, so that Titanine service may be available at every point.

Ruston Aircraft Company Organized

The Ruston Aircraft Company has been organized in Ruston, La., to undertake commercial flying in its various branches. They have a flying field one mile southwest of the city where facilities are available for cross-country fliers.

They have also secured the cooperation of the local towns of Winsboro and Jonesboro in preparing fields suitable for landing, and in the near future supply stations will be established at both of these points.

The officers of the company are T. L. James, president; E. B. Gaither, vice-president and manager; J. B. Kendall, secretary and treasurer. Directors: T. L. James, E. B. Gaither, J. B. Kendall, W. S. Moore, V. M. Davis, R. L. High, S. M. Lewis.

Bremen to Be Big Air Port

Bremen—Eleven million marks have been subscribed for the establishment of an air port here on a huge scale, with extensive aerodrome, custom house, hangars, repairing shops, signalling apparatus and every improvement to facilitate international aerial navigation. This will place Bremen in a far better position than Hamburg, which has not exhibited the same interest in aviation.

Egtvedt Discusses European Aeronautic Situation

All Europe is working secretly to develop craft with which to dominate the air, according to C. L. Egtevdt, aeronautical engineer associated with the Boeing Airplane Company, who returned recently from a tour of inspection of the aircraft plants in England, France and Germany. He believes there is nothing in Europe in the line of aircraft that America can not duplicate. Great Britain was making the greatest development, Mr. Egtvedt found, and Germany was progressing experimentally, though handicapped in producing machines by the terms imposed by the Allies.

"Wherever I went in Europe I found aircraft operating," he said. "The public generally is interested in flying. I was well received in Germany and aircraft manufacturers there expressed a desire to cooperate with America and do business generally with American corcerns.

"British manufacturers and inventors are getting considerable support from the Government. At the Air Conference just held in London civilian and Governmental reports were produced indicating intense interest in England concerning the development of airplanes commercially, not only in Great Britain but throughout the world. There is no fact concerning aviation that the British Air Ministry does not secure and place at the disposal of British subjects.

"It was interesting to learn that $1,000,000 worth of freight has been transported by aeroplane out of the United Kingdom this year. This freight was carried in cargo planes to France, Belgium, Denmark, Spain and Holland. Planes coming into England from the continent carried $2,000,000 worth of imports.

"This last year 1,325 aeroplanes have arrived from the continent and landed passengers and freight in Great Britain. They included 1,079 British machines, 236 French planes, 9 Belgian and 1 Swiss. The planes departing from Britain for the continent aggregated 1,455. Of these 1,206 were British, 341 French, 7 Belgian and 1 Swiss. In analyzing conditions, however, the Air Ministry credits the United States Air Service as being the most successful mail service on earth.

"The British Air Ministry also makes available for general use information on trade conditions, opportunities and problems in all countries. The British hope by this method to establish their aeroplanes in foreign markets, principally in their colonial possessions and in South America."

The Vickers Viking amphibian biplane which recently won one of the Air Ministry prizes. It is equipped with a 450 H.P. Napier engine

ARMY BALLOON SERVICE OFFERS OPPORTUNITIES

By MAJOR R. L. FOSTER

IF a young fellow just out of high school looking about for his first job should cast an observant eye upon a "Help Wanted" advertisement reading something like this, what would he do about it?"

"BALLOONISTS—Wanted 250 young men with a high school education, physically fitted to qualify as balloon observers; $75 a month pay, board and lodging furnished, all clothing and equipment free; no charge for medical and dental treatment. Write Uncle Sam, Washington, D. C.

Boiled down, this is just about how Special Regulations No. 111, prepared in the office of the Director of Air Service, United States Army, would read. The Army Air Service is offering to the young men of the country an opportunity for peace-time education and experience which would be hard to duplicate anywhere else. The new law for the reorganization of the Army authorizes the training of 250 cadets as balloon and airship reserve officers. This training is open to unmarried men between the ages of 20 and 27 years, inclusive, possessing a high school education or its equivalent, who can pass the army physical examination and the physical tests required of all flying officers.

One might naturally expect a novice to pay for this kind of training. But so keen is the desire of Uncle Sam to have a reservoir of officers who know how to handle balloons and other lighter-than-air craft that he has decided to receive applications for training as flying cadets from persons in civil life, and pay them while they learn. This does not mean signing up in the army at $30 per, but the mere engaging of oneself to go in on a cadet status at $75 a month and a ration allowance of $1 a day, together with quarters, clothing, bedding, equipment, and free dental and medical treatment.

"How many high school boys can start life on this sound financial basis?" asks Uncle Sam in all seriousness.

In return he only requires that the young man give the best that is in him. If he cannot complete his course successfully he is honorably discharged. But this is written for those who know no such word as fail; for those who would like to come in on the ground floor as aeronauts for the great future which lies in all the fields of the air.

The lighter-than-air course of instruction covers a period of about ten months, which includes three months with the service balloon company. It is given under ideal conditions at the Army Balloon Schools, Lee Hall, Va., and Ross Field, near Los Angeles, Calif., for free and captive balloon instruction; and at Brooks Field, San Antonio, Tex., and Langley Field, Hampton, Va., for airship instruction. New classes start every four months.

"What becomes of me after I have successfully completed the course?" asks the young aspirant, just about here. "Do I have to stay in the army?"

Not at all. Read paragraph 22 of the regulations:

"Flying cadets appointed from civil life who have successfully completed the course will be commissioned as second lieutenants of the Officers' Reserve Corps, on inactive status, and discharged as cadets."

And those who are found unqualified or unsuited will be immediately discharged from the service with equal honor, but without a commission.

Before 1914, there was no such thing in the American Army as a balloon observer; in fact, such training was practically unknown to any of the armies of the world. During the World War, however, this branch of the service was developed into a highly technical and specialized activity so that now a balloon observer is required to have a knowledge of cordage, balloon fabrics, gas engines, electricity (including telephone and radio insulation), operation and repair, the manufacture and use of gases, particularly hydrogen gas; aerostatics, map reading, aerial photography, panoramic and perspective drawing, in addition to knowledge of the methods of operation of all arms of the service, particularly artillery. At first glance, it seems that the foregoing is an unnecessarily technical course of study for a balloonist, but when it is realized that the balloon observer has a grand stand seat for observing a war and gets an opportunity of seeing at first hand more of actual conflict and range of operation than the commanding general himself, it will be understood why it was necessary that he be highly trained and capable of appreciating what he sees.

A Kite Balloon class at work

As a bulletin issued by the Air Service reads:

"The balloon observer must be a man of rare qualities. That he is a man of courage is accepted as a matter of course, but the kind of courage required is not that which carries a man through hand to hand combat, but which enables a man when in the midst of ever-present danger, carefully, coolly and methodically to carry on work requiring intense mental concentration without thought of his personal safety and without allowing his personal situation to influence his judgment and decisions."

Upon successful completion of the course of observation, the cadet is rated a balloon observer and is then sent to Fort Sill, Okla., to complete his artillery training. After three months of this work, he is commissioned a second lieutenant in the Air Service Reserve Corps and may then be discharged and return to civil life. Should he be called into service at any time he would receive the pay and all allowances of the Regular Army second lieutenant. Further, he may take examination for permanent commission in the Regular Army. Requirements for this are that he be unmarried, under thirty years of age, and be able to pass a mental examination which requires an education equivalent to three years in college.

Quoting the Air Service again:

"This training as a balloon observer opens up an entirely new range of experience to young men. In addition, it lays a foundation for training as a dirigible balloon pilot. This is a field of almost limitless possibilities. Commercial transportation by airship is an accomplished fact in Europe, and according to present plans in the next year will be in actual operation in the United States on a larger scale than the world has ever seen. At the present time, the only opportunity for training as airship pilot is either with the army or the navy. One of the serious drawbacks to commercial plans now under way for airship transportation lines is the lack of quailfied personnel, and indications are that the salaries paid will be very attractive indeed for this reason. Airships have already been constructed which can make the flight from New York to San Francisco in less than one-half the time required by train, carrying fifty passengers with baggage, at approximately the same rates now charged by the railroads. Airships are being designed which will double or treble this capacity with increased efficiency, so that the trip from New York to San Francisco may possibly be made in thirty hours."

Major General P. C. Harris, the adjutant general of the army, has sent detailed instructions to all recruiting officers throughout the country to give full particulars to any applicants desiring to answer Uncle Sam's call for young men who want to become balloonists. The Chief of the Air Service, Washington, D. C., will also send the necessary blank forms to applicants who may apply.

RETRACTABLE CHASSIS AS AN AID TO AEROPLANE SPEED AND EFFICIENCY

By CAPT. JAS. V. MARTIN

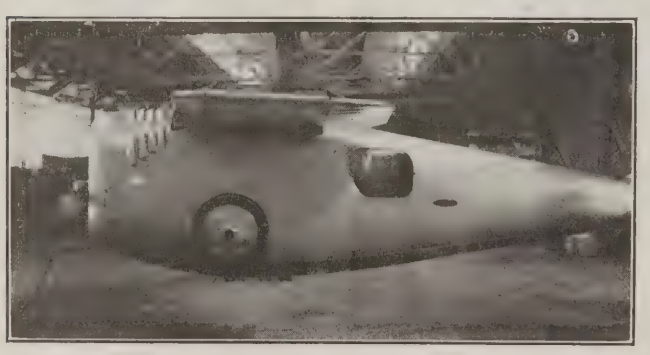
THE most casual observation of animate flying machines impresses one with the wisdom of nature in retracting the creature's alighting gear during flight and the wonder is that aeroplanes have been built all during the great war without taking advantage of the the obvious additional performance obtainable by this means.

Even those unversed in aerodynamics realize that in flight the wing is the sustaining or working organ and that such pendenta as feet dangling or dragging through the air impede progress. The aerodynamic engineer also realized this at the very inception of the aviation art but postponed the effort to retract aeroplane chassis principally because he estimated the disadvantages of an extended chassis in terms of wind resistance only and neglected to consider the ruinous affect such members as wheels, struts and wires have, through "Interference," upon the efficiency of the wing or aerofoil.

Recent wind tunnel experiments emphasize the great detriment of bodies juxtaposed to aerofoils and indicate that "interference" increases rapidly with increased speed. The tests of the Dayton Wright racer are reported to have shown a difference of 30 miles an hour when the chassis was retracted and extended.

Various attempts have been made from time to time to eliminate the major portion of chassis resistance by shortening the distance from the upper portion of chassis attachment to the ground, but the necessity of a certain minimum tail length to insure directional and longitudinal moments and the indispensable (16°) landing angle seem to require chassis which in their most simplified form create large proportions of the "useless" or structural resistance of any practical form of aeroplane.

The importance of retracting aeroplane chassis increases not only as speed increases but also as the efficiency of the aeroplane improves, i.e., the detrimental effect of an extended chassis during flight is greater in a "Clean" aeroplane, like the Jumker monoplane, than it is in one of the "bird cage" type used during the war.



The Dayton-Wright model

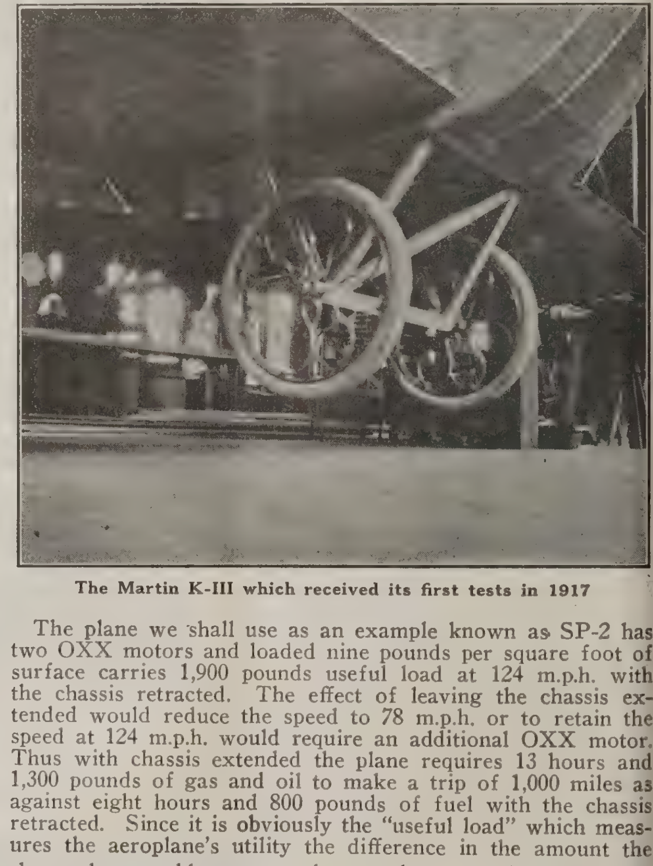
For example Official Government reports show the following values for the chassis on the war type deHaviland and on two modern types of planes.

Parasite Resistance

Aeroplane	Chassis	Body	Wing truss	Control wires
DeH.-4	17%	31%	44%	8%
MRF.	22%	47%	31%	0%
VCP-1	41%	47%	12%	0%

The above is most interesting as a concrete example of the march away from parasite or structural resistance and illustrates forcefully why it is not so important to retract the chassis of an inefficient "bird cage" type plane while it becomes little short of imperative when the aeroplane is refined otherwise. To carry the above data one step nearer the perfect type aeroplane (one having no structural resistance), the Jumker all metal plane shows chassis parasite =44%, body 56%, wing truss 0% and control wires =0%. A new type monoplane of American design shows chassis parasite =61%, body —39 +%, but this job has a retractable chassis so that in flight it shows retracted chassis (portion of wheel left exposed) parasite =7%, which leaves the body resistance parasite in flight 93%, but the body resistance of this plane is so low that its entire parasite does not equal its wing resistance until speeds of over 160 m.p.h. are reached.

The last mentioned plane while representing quite an aerodynamical advance is only one more step in the progress toward the perfect type, or wing type aeroplane, of the future, so in using it as an illustration of the influence of retractable chassis upon performance we will be understating the case for the retractable chassis as applied to the more refined planes of the future.



The Martin K-III which received its first tests in 1917

The plane we shall use as an example known as SP-2 has two OXX motors and loaded nine pounds per square foot of surface carries 1,900 pounds useful load at 124 m.p.h. with the chassis retracted. The effect of leaving the chassis extended would reduce the speed to 78 m.p.h. or to retain the speed at 124 m.p.h. would require an additional OXX motor. Thus with chassis extended the plane requires 13 hours and 1,300 pounds of gas and oil to make a trip of 1,000 miles as against eight hours and 800 pounds of fuel with the chassis retracted. Since it is obviously the "useful load" which measures the aeroplane's utility the difference in the amount the above plane could carry on the one thousand-mile trip would be—with chassis extended 600 pounds, with chassis retracted 1,100 pounds.

Our illustrations show two forms of retractable chassis, both licensed under the J. V. Martin patents, The Dayton Wright job is the cleaner in the air as it leaves none of the chassis parts exposed, but on the other hand the chassis when retracted occupies considerable of the fuselage space whereas the picture of the K-3 reveals a form of tractable chassis which, housed in a falsework along the bottom and sides of the fuselage does not occupy needed space.

There will doubtless be countless forms of retractable chassis to meet the difference in requirements and form of aeroplanes, but one thing seems certain, that in one form or another future aeroplanes will have retractable chassis as standard equipment and this distinctly American invention will do much to hasten the day when the aeroplane will seriously compete with railway and steamship as universal carrier.

REPORT ON GERMAN WIND TUNNELS AND APPARATUS

By EDWARD P. WARNER

THE National Advisory Committee for Aeronautics, in view of the important research work that has been conducted in the German wind tunnels at Göttingen, Aachen, Dessau, and Friedrichshafen, requested Professor Edward P. Warner, the committee's acting technical assistant in Europe, to submit the following report, descriptive of the above mentioned wind tunnels, together with methods of operation and details of the apparatus used.

It is appropriate that any discussion of aerodynamical work in Germany should begin with Göttingen and with Prof. Prandtl, where the first serious work of the kind was undertaken, before the war, and where the most extensive and interesting results have been obtained both in respect of wind tunnel testing and of purely mathematical investigations.

There are at the present time, two wind tunnels at the Göttingen laboratory, one being the original 1-meter tunnel of pre-war days, but moved into a new building; the other a newer installation 2 meters in diameter. During the war both tunnels were kept in service, but that is impossible with the present shortage of funds and of employes, and the small tunnel is now seldom used. The small tunnel was described by Dr. Zahm in his report to the Smithsonian Institution in 1913, and need not here be gone into in detail. The newer and larger one is built on essentially the same principle, but with substantial modifications in detail. In the first place, the plane of the closed circuit which the air follows has been turned from the horizontal to the vertical, the return passage being underground. The whole tunnel, except the portion immediately around and adjacent to the test section, is made of concrete, so there is no question of air-tightness.

The section, 2 meters in diameter at the throat, expands in each direction to a diameter of 4.5 meters before the first turns are reached, and this size is maintained all the way around the return, making an area ratio of 5 to 1. The air is still guided around the turns by means of vanes, but these vanes are no longer adjustable in position or inclination to secure regularity of flow, such adjustment having been found unnecessary, nor are they now made in honeycomb form. They are cast in the concrete, are of crescent form with a maximum thickness of about one-fifteenth of the chord, which is about 18 inches, and are spaced approximately 8 inches apart. The vanes are not arranged to cause all the particles of air to swing about a common center, as might perhaps be expected but are all of the same size and all curved to the same radius, so that the outside boundary of the tunnel comes to a corner and the section is increased at the turns.

The stream is not enclosed at its throat, although a tube is available which can be put into place to partially restrain the flow if desired. The stream being enclosed at every other point of its travel, the pressure at the throat is the atmospheric pressure in the free air, while that in the return passage is raised above atmospheric, and no experimental chamber of air-lock is necessary.

The only means provided for regularizing the flow is a honeycomb placed in the large section of the tunnel, berore the contraction to the throat begins. This honeycomb is made up of metal plates separated by corrugated strips, so that the cells have a rather eccentric form, approximately semicircular. The mean effective radius of these cells is about ⅜", the length 8 inches. Prof. Prandtl lays great stress on the value of placing the honeycomb where he has it, before the entrance cone, in order to avoid turbulence and minute eddies which he believes are produced by a honeycomb of the ordinary type. Admittedly there is some loss in regularity of flow as ordinarily judged when the honeycomb is moved farther away from the throat, yet the regularity of Göttingen seems to be very good. Incidentally, I found Capt. Toussaint quite convinced of the merits of Prandtl's placing of the honeycomb and preparing to adopt a similar disposition at St. Cyr, and the matter was also receiving serious consideration at the N. P. L.

The current is produced by a four-bladed wooden propeller of ordinary type, driven by a 300 H.P. electric motor. The maximum wind speed obtainable is 50 m. per second, which, if the motor is working at rated power without overload, corresponds to an energy factor of 1.36 (a result not in any way remarkable). The motor is outside the tunnel and drives the propeller by a shaft passing through the wall at the turn.

The forces and moments on the models are ultimately weighed on ordinary platform balances, the only special apparatus being that which transmits the forces from the roof of the tunnel, or, more properly, from the platform erected above the air-stream, down to the balances which are placed conveniently for the observers standing on the floor. The apparatus is primarily of interest in that the support in all cases is solely by wires, no spindles being used under any conditions. Furthermore the measurements of lift and drag are direct and entirely separate, no moments entering in until the balances are reached.

In the case of an airship model or other similar streamline body, the support is by five wires. Four of these are arranged in two pairs the two members of a pair attaching to the model at the same point and then diverging, their plane being perpendicular to the direction of the wind. One pair is attached about a quarter of the way back from the nose of the model, the other about three-fifths of the way back. The fifth wire is attached at the same point as the forward pair, and runs forward exactly parallel to the wind direction. At a point about two feet forward of the nose of the airship this wire terminates in a small ring to which are also fixed two other wires, one running vertically upwards and the other obliquely downwards and forwards to the floor at the end of the entrance cone. This diagonal wire is simply fixed to a screw-eye in the floor, while the vertical wire is attached to a crank on a rocking beam, another offset crank on which bears against a vertical rod running down to the pan of the platform balance. The pull in the vertical wire can thus be weighed directly, and, knowing the directions of the other two wires attached to the ring, the pull in the horizontal wire, which is equal to the drag of the model, can be calculated. As a matter of fact, I believe, although I am no certain, that the oblique wire runs off at just 45°, so that the balance reads the drag directly with ordinary weights. The total pull in each pair of vertical wires is similarly measured, the two members of a pair being attached to two cranks on a single beam so that the total is obtained directly. The lift on the model is then equal to the sum of the two readings (correction having been made for the tensions due to the weight of the model) and the pitching moment can be directly calculated from their difference. The angle of attack is adjusted by raising and lowering the rear beam and wires. Of course, as the angle is changed the horizontal distance between the points of attachment of the two sets of wires changes, and, if the rear beam were raised or lowered vertically, it would be impossible for both pairs of wires to remain truly vertical. The two beams are therefore connected together by a link forming, with the two sets of wires and the line connecting their points of attachment in the model, a parallelogram. The five wires suffice to restrain the model from all motions except those in roll, and these are resisted by its own weight. As an additional safeguard against rolling, a wire may be attached to the lower surface of the model and run downwards and backwards over a pulley, a heavy weight being hung at its free end, thus introducing a constant correction to both lift and drag. Despite this precaution, the model of an airship which was being tested while I was at the laboratory several times started oscillating badly and it was necessary to reach into the current with a stick and steady the model just before the final balance readings were taken.

In the case of wings, the same balances are used and the method is essentially the same, but there are differences in details of attachment. The model is made with four hooks cut from thin sheet metal mounted on it, three of these hooks being distributed along the leading edge and the fourth carried by a rod which projects about one and a half chord lengths to the rear of the trailing edge. The two hooks mounted near the tips on the leading edge carry wires running vertically to the forward lift beam the center hook carries the wire which runs forward to measure the drag, and the rear hook, on the rod, forms the point of attachment for two wires running off in a V to the rear lift beam. The model is then definitely fixed except in regard to yaw. Should any particular model show a tendency to oscillate in that respect it can easily be checked by running two wires from each corner of the leading edge to the forward lift beam, the whole set of four then appearing from the front as a W. This is to be done as a regular practice at the Zeppelin laboratory.

The spindle correction for wings is obtained by substituting for the model a T made of two pieces of stream-line wire about ⅝" x 3/16" in section. The cross-arm of the T has a length equal to the span of the aerofoil, the shank a length equal to the distance between the leading edge of the aerofoil and the rear point of attachment used for the determination of pitching moments. This T is hung up in exactly the same manner as the model, and the drag measured. The resistance of the stream-line wires being known with fair accuracy by computation and by previous experiment, the effect of the supporting wires can be determined at once by subtraction. In the case of an airship model the method is the same, but a single pointed rod is used in place of the T, the rod being held parallel to the wind direction. The method is not absolutely satisfactory in this case, as no allowance is made for the interference between the supporting wires and the model, which is quite different from the interference between the supporting wires and the rod, but the percentage error from this cause is undoubtedly very small.

The wing models in use at Göttingen are all made of plaster, scraped to form while still soft. One or, more usually, two aluminum plates are used as the core. The finish is excellent, as good as I have even seen on plaster models, although I think it is no better than on the best of the models made for the Garden City laboratory. The standard size of wing model at Göttingen is 1 m. by 20 cm., an aspect ratio of 5.

The method of regulating the wind speed is of particular interest, as it is entirely automatic and seems to work with absolute perfection. The speed is fundamentally measured, in accordance with the usual practice by measuring the pressure difference between the large and the small sections of the tunnel. The pressure difference is measured by leading the pressure which differs from atmospheric in under a cup the rim of which dips in oil, and by weighing the "lift" on this cup with a balance, just as is done at the Leland Stanford tunnel. In this case, since the pressure under the cup is greater than atmospheric, the weights have to be hung on the same side of the balance axis with the cup. On the other arm of the balance is an oil dash-pot, while a long pointer runs downwards from the balance axis and moves between two contacts. The arrangement is shown roughly in the sketch (page 5). As the pointer makes contact on one side or the other a servo motor is started in one direction or the other, steadily moving a rheostat and increasing or decreasing the motor speed, in such a way as to bring the wind speed back to normal, until the contact is broken and the pointer once more floats freely. In order to secure a greater range and a more sensitive maintenance of speed, the pointer is made with a subsidiary contact in the form of a light flat spring on each side of the main contact, and these subsidiary contacts actuate a fine rheostat. If the deviation from normal speed is really large, the unbalancing of the beam overcomes the resistance of the light contact spring and the beam moves far enough to bring the main pointer into contact with its stops and actuate the coarse rheostat. In order to prevent the fine rheostat being brought up against its stops, a contact is automatically made when the handle draws near to the limit of its travel and this moves the coarse rheostat one step. The whole adjustment is now automatic. There is a push-button starter, and, the motor once started, the operator has only to hang the proper weight on the balance (the weights are marked directly in meters per sec.) and go away and leave it.

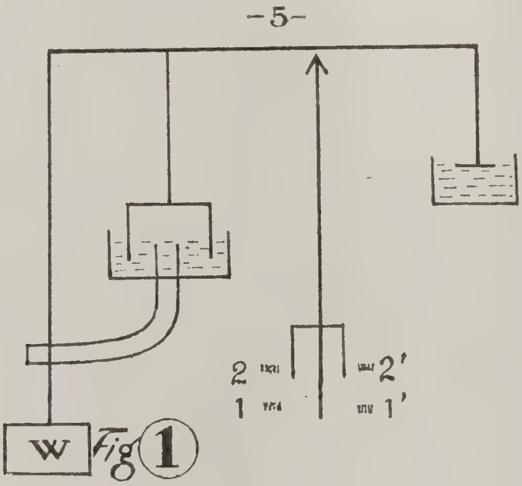


Fig 1

1, 1'—Coarse Rheo. Contacts.
2, 2'—Fine Rheo. Contacts.

Although it appears that not much stability work has been done at Göttingen, a balance for measuring all forces and moments simultaneously is now under construction and is nearly completed. For this purpose, the model is hung from a platform, the model being heavily enough ballasted to keep all the suspension wires taut. These suspension wires are rigidly attached to the platform. The platform is held in position by six wires, two running vertically, two parallel to the wind stream, and the remaining pair horizontally and perpendicular to the tunnel axis, and the simultaneous measurement of the tensions in all these wires permits of the calculation of the six forces and moments acting. This is much the same in principle as the roof balance which has long been used for certain special experiments at the N. P. L. and to the all-wire-support roof balance which is now being designed at the R. A. E. The most interesting and original feature of the Göttingen balance is the automatic adjustment of the six balances, all of which are arranged in a row before the operator.

The method is best explained by the sketch below. The arm of the balance which is to carry the weights bears against the top plate of a very flexible sylphon into which air at a low pressure is continually pumped through the pipe A. The pressure which can be reached inside the sylphon is limited by the outflow pipe B, which contains a constriction at C to permit the building up of a pressure. The balance arm has attached to it a horizontal rod and a needle-valve controlling the outflow from the main supply pipe by another passage without passing the constriction C. If the pressure inside th sylphon is so great that the total lifting force on the top plate is greater than the downward pressure of the balance arm the arm is lifted, opening the air-valve at D and permitting a drop of pressure and the descent of the arm and reclosing of the valve. This apparatus, however, sustains only a small part of the maximum force acting on the balance, and weights must be hung on the balance arm in the usual way. These weights are normally carried by fingers on a rack which can be moved vertically by rotating a hand-wheel, and, as the rack is lowered, the weights are transferred to the scale-pan one at a time. The amount of weight resting on the scale-pan at any time is shown by a revolution counter attached to the hand-wheel which adjusts the rack. In taking a reading, then, it is only necessary to rotate the hand-wheel until the balance arm drops, to turn on the air at the sylphon, and then to read the revolution counter and the air-pressure gauge. All six of these balances could be operated without difficulty by a single observer. On this new balance, as on the one now in existence, the workmanship is good where it needs to be good, but no time or money has been wasted on finish where it does not affect the working of the instrument. The sensitivity of the balance now in use is a little better than 1 g., both on lift and drag.

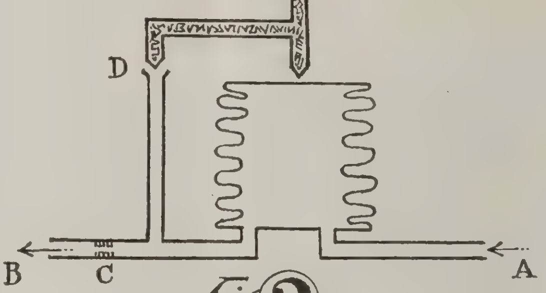


Fig 2

No propeller testing has been done at Göttingen recently, but a propeller balance of unique type has been designed and partially constructed. The propeller under test will be driven through bevel gears and a vertical shaft from a motor outside the wind-stream, and the whole apparatus, motor, transmission, and propeller, will be carried on floats in a tank of water or oil. The thrust is to be measured by the combined pull in two wires running parallel to the wind direction, the torque by the pull which has to be applied to a vertical wire attached to one side of the floating platform in order to keep that platform horizontal. The cross-wind force and pitching and yawning moments can also be obtained with ease if desired by running other wires in suitable directions. In order that the measurements of torque may be sensitive, the inherent stability of flotation must be small, so that the angle of tilt due to the torque would be large were it not for the restraining wire. In order to accomplish this the metacentric height must be reduced or, since metacentric height is equal to I/V and V is fixed by the weight of the apparatus, the moment of inertia of the water-line section about a longitudinal axis must be made as small as possible without actually bringing the metacenter below the center of gravity. This is done in the Göttingen apparatus by making the floats proper of such a size that they will be completely submerged and the surface of the water will only be broken by the tubes which connect the floats to the platform. The propellers tested are to be one meter in diameter.

Great confidence is felt at Göttingen that the Prandtl theory of wing action together with the work done along the same lines by Munk and Betz, now furnishes a practical tool for the engineer. There is no question of the consistency of the results obtained within a certain field, and notably in predicting the effect of changes in aspect ratio. A series of tests on wings of the same section but of different aspect ratios was recently made, and when the results obtained were reduced to aspect ratio 5 by Prandtl's formulae all the points lay, well within the experimental error, on a single curve. In view of this, Prandtl considers further testing for aspect ratio effect on new sections as quite unnecessary.

Aerodynamic Work at Aachen

A regular course in aerodynamics is given by Prof. Karman at the Technische Hochschule at Aachen, and there are a number of students undertaking investigations in that field. The laboratory equipment, however, is very limited. The only wind tunnel, available is on the roof of the building and takes its air from the free atmosphere, with no protection from gusts. It is also very short, and the flow is so irregular that it would be impossible to work with wings or, indeed, to do any work at all with a balance. The tunnel is two meters in diameter and has a 100 H.P. motor, realizing a speed of 33 meters per sec. There is no expansion in the exit cone, the sirocco fan which produces the current being of the same diameter as the throat of the tunnel. The experimental chamber is enclosed as in the Eiffel type, and the irregularity of flow in the stream is attested by a pronounced circulation of air all round the chamber. The honeycomb cells appear too large for best results, being about eight inches in diameter and two feet long. The most interesting thing about the Aachen tunnel itself is its noise-making characteristic. Up to about 25 meters per sec., while not by any means silent, the amount of noise is not unusual for the corresponding size and speed. At that speed there is a sudden change, and above 25 m. per sec. there is an ear-splitting shriek totally unlike anything that I ever heard from a wind tunnel before. The most peculiar thing about it, however, is that if one thrusts an arm into the stream until the hand is near its middle the high-pitched noise instantly stops, recommencing as soon as the arm is withdrawn. The question of noise in wind tunnels is at present considered as a vital one all over Europe, having come up for discussion without any effort on my part at Aachen, St. Cyr, Teddington, and Farnborough, and a multitude of different causes are ascribed. The problem is a very interesting one allied to, but more complex than, the general question of propeller noise, on which Bryan and Lanchester have already done some work and on which the former presented a paper to the British Association last year. Apparently no one has even attempted to explain completely the strange behavior of the Karman tunnel, but it is evidently due to the formation and dissipation of eddies with an accompanying strong reduction of pressure and density. The sound is not unlike the whine of a high-velocity bullet as its passes overhead.

At the present time the Aachen tunnel is working chiefly on the heat dissipation from and the flow of air through radiators. In carrying out these experiments a section of the radiator is closed off from the remainder, so that no water can flow though it, and minute holes are made in the sides of these isolated passages. Connecting the holes thus made to a gauge, the static air pressure is found at several points between those where the air enters and where it leaves the radiator, and the resistance can be studied and computed from the pressure gradient thus found, in the manner commonly employed in examining the flow of fluids through pipes. Water is pumped through the radiator at variable speeds and variable inlet temperatures and the heat dissipation is computed in the usual way.

Prof. Karman anticipates doing some work at very high velocities with the aid of a 100 H.P. centrifugal compressor delivering air at a pressure of one-half atmosphere, but no start has been made as yet.

Karman is now working on the theory of turning wings, or wings which rotate simultaneously, but not necessarily with constant or equal angular velocities, about an axis in the plane of the chords and about another axis parallel to the first but at a considerable distance from the plane of the chords. If the two rotations are properly adjusted to each other there is a lift and also a driving force, the action being something similar to that of flapping flight and eliminating the need for a propeller. The investigations now being made are directed towards finding the most efficient type of rotation, and will be followed by actual experiments with such wings. Another professor at Aachen is specializing in the study of the equations of viscous flow and attempting to apply them to aircraft parts, apparently proceeding somewhat along the lines on which Bairstow is now working.

A small water-channel is being used by one of Karman's research students for photographing the flow through diverging and converging passages of various sorts with a view to analyzing the flow in the exit and entrance cones of wind tunnels. Aluminum powder is used for making the flow visible. The most striking thing about the results so far obtained is the abrupt change in type of flow, which appears about ten seconds after the motion has commenced, the flow initially "filling" a diverging cone and then breaking away from the walls, passing straight down the center as a stream of approximately constant cross-section with a region of deadwater on each side. Unfortunately, no moving pictures have as yet been taken to show the exact mechanism of the change. The alteration of the flow probably depends at least in part on the cessation of acceleration and the establishment of steady conditions.

During the war Prof. Karman was in Austria and had there a very large wind tunnel, which, however, does not appear to have been run for very long or in a very scientific manner. The tunnel was 3.2 meters in diameter, and propellers up to a diameter of 2.8 meters were tested, the ratio between these figures being far larger than has ever been considered safe elsewhere. The speed attained was 40 meters per second. The propeller thrust and torque were measured by the pendulum method, the whole apparatus being carried by four parallel wires. The tunnel was apparently rather short in proportion to its diameter, and the motor driving the propeller under test and the supporting wires were placed outside the mouth, a long shaft projecting along the entrance cone to drive the propeller. The whole tunnel was on wheels so that it could be moved to one side when the pendulum apparatus and driving motor were to be used for making static tests. The cost of the tunnel was one million kroner, or $200,000 at normal rates of exchange.

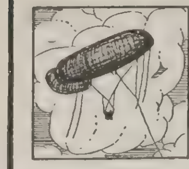
The Junkers Laboratory at Dessau

This wind tunnel is hardly to be compared with Prandtl's, as the aim in its construction was entirely different. The Junkers laboratory is admittedly solely commercial in its aims, its only object being to furnish data for improving the Junkers aeroplanes. None of the work done there has been published, and there is no intention of publishing any. The experiments at Dessau have been chiefly concerned with the development of improved sections for cantilever wings, although a little stability testing of an elementary sort has been undertaken, and the constant attempt has been to speed up and systematize the making of routine tests with a moderate degree of accuracy, rather than to seek increased refinement in measurement.

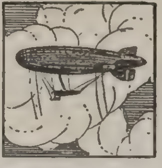
The Junkers tunnel is octagonal in section, but the octagon is not a regular one, the breadth of the stream being 1.2 meters, the height only 0.9. A fan is used instead of a propeller for producing the air-current. The tunnel is of true Eiffel type as regards the experimental chamber, and a couple of inches of water is left standing on the floor at all times to minimize leakage and to suppress the dust. The drive is by an electric motor of 100 H.P., and the maximum wind-speed is 39 meters per second, giving an energy ratio of .497/.

The steadiness of flow in the Dessau laboratory seems distinctly inferior to that at Göttingen, and there is no question that there is more disturbance of the air in the room and spreading of the stream. The honeycomb is similar to that used by Prof. Prandtl as far as the form and arrangement of the cells are concerned, but it is placed at the beginning of the throat instead of at an enlarged section. The cells are ½" in mean diameter and 2" long.

(To be concluded)



FOREIGN TECHNICAL DIGEST



French and British Airships

This article is an eulogy of German airship construction. The author traces the history of French non-rigid airships during the war and gives details of the different types evolved. French airships are treated with scant respect, but the author thinks more highly of British ships. The different types of non-rigid airships are described, and then the R-34 and L-59 are compared. The British ship is stated to be an inferior slavish imitation of the German ship. Comparative data are given and the flight of the R-34 to America is set off by the flight of the L-59 from Bulgaria to Khartoum and back. (*Auto-Liga,* July 31, 1920. 6 cols., 3 figs.)

High Altitudes and the Human Organs

A popular account is given of two theories to account for flying sickness and of the experiments on which these theories are based.

The French school, headed by Profs. Bert and Regnard, holds that it is caused by shortage of oxygen, while the Italian school, led by Prof. Mosso, maintains that shortage of oxygen does not of itself account for the sickness, but that collapse is due to lack of carbonic acid in the blood at high altitudes. Up to 9,000 meters, application of oxygen will overcome the sickness, but above that height a mixture containing carbon dioxide and oxygen is necessary. (CO_2 13 per cent, O 87 per cent has been found satisfactory.) (Dr. Guglielminetti, *La Suisse Aérienne,* May, 1920. 5 cols., 2 figs.)

Physiology of Aeronauts

The article describes flights undertaken under different circumstances in order to investigate the limits to which pilots can go in for manœuvring the machine without endangering their machines.

The sensations felt under the various conditions are considered, and from the observations deductions are drawn concerning the characteristics necessary for safety in flight. (Dr. A. Stettbacher, *La Suisse Ariénne,* Apr. 25, 1920. 5 pp.)

The Ricci Triplane

This is a small sporting single-seater machine with a low landing speed.

The construction is simple, compact, and strong. The following are the principal characteristics of the machine:

Span (all three planes)	3m.50
Length	3m.75
Height	2m.30
Wing area	11 sq. meters
Weight, empty	150 kg.
Engine	40 h.p., 6-cyl. Anzani
Maximum speed	150-160 km. per hour
Minimum speed	30-40 km. per hour
Endurance	3 hours
Weight, fully loaded	260 kg.

(*L'Aérophile,* May 1-15, 1920. 1 col., 1 fig.)

Pressure Distribution Round Cylinders Whose Axes Are Perpendicular to the Wind Direction

The experiments were made upon cylinders 14 mm. in diameter in a channel 250 mm. in diameter.

The pressure distribution was observed round the median section in two cases: (*a*) With a cylinder 100 mm. long, (*b*) with a cylinder 250 mm. long, *i.e.,* extending right across the channel and, therefore, equivalent to an infinitely long cylinder. The pressure region on the front of the cylinder was found to extend over an angle of 83° in case (*a*) and 75° in case (*b*). The suction in case (*b*) was a maximum at angles of 70° with the wind. It decreased in value from 70° to 90° and was sensibly constant from 90° to 180°. The absolute values of the suction were greater in case (*b*) than in case (*a*). The pressure at any given angle was proportional to the square of the speed, whereas the suction was not.

Experiments were also made upon three cylinders of diameters 11 mm., 18 mm., and 20 mm., 100 mm. in length, to determine the angle at which the pressure changed from positive to negative. These angles were found to be 36°.5 to 37°.25; 47°.2 to 46°.75; and 45°.5 to 46°.5 respectively. If the angle over which the pressure region extends is plotted against the ratio L/D it is found that the angle decreases with increasing L/D up to $L/D = 10$, after which it remains constant at about 75°. In the case of the 100 mm. by 14 mm. cylinder, the pressure distribution around a section situated near one end was also observed and was found to differ somewhat from the distribution on the central section.

Appendices are given containing a résumé of all the more important contributions to the subject of the resistance of cylinders in a wind. English, French and German papers are quoted and the results contained therein are briefly stated. (A. Toussaint and Lieut. Weisenburger, *L'Aeronautique,* Apr., 1920. 16 cols., 10 figs.)

Medical Point of View in Aeronautics

The article discusses briefly the effect of flying on the various organs of the human body, and the author affirms that no ill-effects observed are peculiar to flying, those noticed being identical with the effects obtaining in a state of fatigue.

Flying does not produce any permanent injuries in the physically fit. The chief effect induced is an increased arterial tension, but in ordinary cases this rapidly becomes normal. The urinary and nervous systems, and the digestive organs may be affected. It is pointed out that good pilots are not those who react rapidly to sensations, but those in whom the reactions subside stably.

Two things are required to counteract these ill-effects: First, increased comfort in cabins and some form of air-tight cabin for high altitudes, and secondly, application of a mixture of oxygen and carbonic acid gas, in proportions to be determined, at a pressure near atmospheric pressure. (Dr. A. Mathieu de Fossey, *L'Aeronautique,* May, 1920. 5 cols.)

Construction of the Metal Aeroplane

In connection with aeroplane structures the use of wood, whilst offering advantages in regard to lightness and elasticity, is considered fundamentally defective owing to weakness at joints and uncertainty in the factor of safety.

Methods of construction are preferred which, it is considered, lead to more durable and permanent results, and permit of a lower factor of safety than that customarily adopted; these methods render the machine lighter and more efficient, and offer greater uniformity from the mechanical standpoint.

In regard to weight and strength, the following figures are quoted, a load factor of 6 being allowed in reducing the tensile strength:—

Material	Weight (A) per metre³	Reduced Tensile Strength (B) per sq. cm.	B/A
Amer. Ash or Pine.	750 Kg.	125 Kg.	0.166
Soft Nickel Steel...	7,800 Kg.	1,667 Kg.	0.210
Ordinary soft Steel.	7,800 Kg.	917 Kg.	0.155

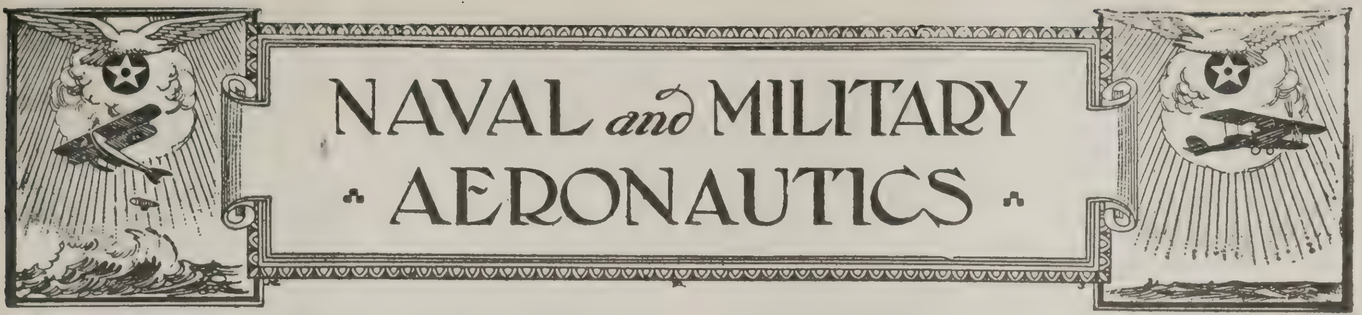
From the standpoint of strength and weight the figures illustrate the advantage of use of soft nickel steel in preference to wood, an economy of weight amounting to 20 to 25 per cent. being claimed if structures of the same strength and general external form and profile be compared.

Some particulars are added in regard to weight and strength for a number of aluminum alloys. With reference to the aluminum bronzes little real improvement in the mechanical strength is anticipated without increasing the copper content, and consequently the weight, to such a degree as to impair the value of these alloys for aeronautical construction. Results obtained from alloys of aluminum with lead, tin, bismuth, antimony and nickel, and other metals and metalloids are considered unsatisfactory. Further research may, however, prove fruitful. Other considerations affecting the suitability of any particular metal include its malleability and ductility, elasticity, endurance against impact and vibration, chemical and electrical properties, and especially the possibility of constructing satisfactory joints by welding.

A metal wing covering of thickness 0.2 mm., although of considerable weight per unit area (0.5 kg. per sq. metre) compared with fabric, shows to advantage in contributing to the overall strength of the structure. Its rigidity is considered to be such that the number of ribs could be reduced, with a corresponding reduction of weight, the covering assuming a slight downward curvature in the spaces between the ribs, such as would, it is said, improve the longitudinal stability. Further, the type of covering contemplated would extend over the complete under surface and leading edge of the wing, the rib section of the upper surface remaining uncovered. Aerodynamical experiments are quoted in support of the efficiency of this arrangement.

It is remarked that with the metallic wing the moving parts and hinges could be designed with greater precision and methods of altering wing incidence could be developed. The possibility of securing variable wing area is suggested, by aid of a telescopic upper wing cover. Simplicity is claimed in the metallic construction of the remaining aeroplane parts. (Prof. E. Garuffa, *L'Industria,* Dec. 31, 1919. 11½ cols., 5 figs.)

NAVAL and MILITARY AERONAUTICS



Admiral Hugh Rodman of Pacific Fleet Commends Air Force for Excellent Work

The Commander-in-Chief of the Pacific Fleet, Admiral Hugh Rodman, commended very highly the Air Force in the prominent part they played in the recent fleet maneuvers off San Pedro.

"The scouting work performed by the seaplanes was carried out to a distance of about 165 miles from the base and in weather which, except under war conditions, might have caused the Commander of the force to hestitate about sending the planes into the air. So far as the Commander-in-Chief is advised the work of all other units of the force was equally well done. The performance of the Air Force shows not only that it was well trained for this particular ,work, but that great attention has been given to the upkeep of material and the training of the personnel. Both the efforts made and the results accomplished reflect the greatest credit on the Commander of the force and on the entire officer and enlisted personnel."

Captain H. C. Mustin, Commanding Officer of the Fleet Air Detachment expressed his commendation to the whole Air Force, and especially to the Seaplane Squadron and such personnel of the North Island Air Station as served temporarily with the Air Force during the recent performance of duty in the fleet maneuvers.

Martin Torpedo Planes Arrive at North Island

Four Martin bombing planes have arrived at North Island Station from Cleveland, Ohio, and will soon be seen in the air here.

These new monsters of the air will have a wing spread of 71 feet 5 inches, the fuselage measures 45 feet 8 inches and the machine is 15 feet 5 inches in height. These monster bombing planes will weigh 6,742 pounds when completed and will have a total gross life of 11,909 pounds, which includes the torpedo that she will carry, which will be an 18-inch mark 7 model 5 and will have the total weight of 1,650 pounds, plus the 4,501 pounds of bombs and two machine guns of the Lewis type one in the forward cockpit and one in the after cockpit; the latter will be manned by the mechanic, who will evidently have his hands full all the time handling the motors of so vast a plane and also a machine gun.

The interesting features of these planes lie in the fact that they are so vast in dimensions and are still capable of making approximately 100 miles per hour, and are to be driven through the air at that terrific speed by two 400-horsepower high compression Liberty motors.

Ensign E. E. Reeder has been appoined pilot of the first Martin bomber to be actully put in service on this coast. His vast experience in the air has made this step possible, and his persistence has been rewarded by getting the honor of being the first naval officer to pilot this type of plane.

Rickenbacker Will Aid University of California

Berkeley—Captain Eddie Rickenbacker, the American ace, has offered to give instruction in flying to a class of students from the University of California to aid the college in carrying out their plan to establish a flying school on the university campus. Rickenbacker will co-operate with the university in giving instruction in actual flying at Durant Field. It is planned that this course will be operated in connection with the ground schools which are to be organized both by the regular college military department and the university extension division.

Aviators Lay Out Route of Railroad

Manila.—Locating a railroad by aeroplane is the latest venture of the Third Aero Squadron, Camp Stotesburg, Philippine Islands, and one long flight has enabled a railroad engineer to determine which one of three general routes will be utilized for the new road. The innovation has resulted in the saving of many months of time and thousands of dollars. Instead of three parties of locating engineers being sent out to make the preliminary survey, only one will now be necessary.

The Manila Railroad Company has planned the extension of its line from Cabantuan through parts of the Provinces of Nueva Eciji and Nueva Vidoaya to Bayombong. Parts of the two provinces are very thinly settled and no comprehensive maps of surveys were available. The military authorities are vitally interested in the extension of the Manila Railroad Company line and accordingly permission was obtained from the Commanding General, Philippine Department, to use a Government aeroplane on the preliminary surveying trips.

The Lure of the Air

FOREIGN NEWS

Surveys in Burma by Aeroplane

Advantage is to be taken in the cool weather which may be expected in December to survey some of the Burma forests by aeroplane. It is expected that air photographs will be taken and maps made of great tracts of forest which are practically unexplored. What might be learnt in a day's trip in an aeroplane might occupy a whole dry season in an ordinary land expedition.

Flight Over Mont Blanc

The first flight carrying passengers (two in number) was made over Mont Blanc on October 5th by the Swiss aviator, Pillichody.

German Air Traffic

Writing in the special Peace Number of the *Weltwirtschafts-Zeitung* (September), Herr Paul Sackerwitz, of Berlin, states that:

"The results of the first six months recently published by the German air stations are thoroughly encouraging. The question of safety, which is the paramount one among the majority of travellers, can be most satisfactorily answered. Of 1,532 flights, 1,430—that is, 93.3 per cent.—came off absolutely successfully; only 4.7 had to be interrupted for technical or meteorological resaons. Two per cent. could not take place at all, owing to weather difficulties. Altogether 556,155 kilometres, or more than threefold of the earth's circumference, were travelled. The cargo carried amounted to 20,963 kilogrammes mail, 57,081 k. newspapers, and 5,098 k. parcels. If we add to these figures the 1,574 passengers transported, averaging with their luggage 75 k. per head, the total weight-transport figures for the first six months are 201,156 kilogrammes. This success is far greater than even experts would have expected.

"German air conveyance took its first flights abroad at the end of September. On September 29 a giant aeroplane of the German Air Navigation Company flew from Berlin to the Amsterdam Exhibition. The voyage there took six hours; the return journey only four and a half. On October 8 the memorial voyage of the Zeppelin liner *Bodensee* to Stockholm followed. In a short time German traffic aeroplanes will be flying to Denmark and Sweden."

A School of Aviation in Valparaiso

A sum of 565,000 dollars has been raised by a committee, aided by a Government grant, for the purpose of founding a civil school of aviation in Valparaiso. The aerodrome is to be complete with hangars and workshops. Suitable ground to the extent of 1,250,000 sq. metres has been secured, and part of it will be laid out for football matches and other outdoor sports.

An Award to Mr. F. P. Raynham

On the report of the officials who attended the Gordon Bennett Race at Etampes the Royal Aero Club committee have voted a sum of 200 guineas to Mr. F. P. Raynham in recognition of his very sporting effort to win the cup for Great Britain.

A vote of thanks was passed to Lieut.-Col. F. K. McClean, Lieut.-Col. Mervyn O'Gorman, C.B., Lieut.-Col. W. A. Bristow and Mr. R. J. MacGeagh-Hurst for the assistance rendered by them to the British competitor at Etampes.

The London-Bucharest Flight

The machine in which Mr. Reginald Wright recently made a flight of 3,250 miles, from London to Bucharest and back, in a flying time of 34 hours 20 minutes, was a D.H.9 standard Siddeley-Puma, of 230 h.p.

Civil Aviation in Austria

Although there is practically no civilian flying in Austria at the present time, the possibilities are not being lost sight of. As a matter of fact, several landing grounds are being prepared and others are already available at Linz, Salzburg, Innsbruck, Graz, Wels, Steyr, etc. It is hoped, when the conditions of the Peace Treaty permit, that the North German Lloyd group will commence to run some services.

France's Policy in the Air

Speaking at a banquet held on October 9, M. Flandin, Under-Secretary of State for Aeronautics, outlined the future air policy of France. He advocated the continuation of close working between the civil and military organizations, and went on to emphasize that efforts should be concentrated upon the improvement of the technical side of aviation rather than upon the increase of the *matériel.*

While he expressed the opinion that Germany was not to be feared in regard to the numbers of her aroplanes, he said that her experimental activities must be emulated; new laboratories should be installed, makers should be formed into groups, so as to reduce prices by co-operative buying, and aeronautical engineers be given special encouragement in their work.

"We must attempt to hold the supremacy in the air," he said, "as England holds it on the sea, for a nation that controls the means of transport is mistress of the world."

Big Air Station for Copenhagen

Word comes from Copenhagen that the Danish Budget Committee has granted the necessary one and a half million kroner for the purchase of 320 hectares of land at Kastrup, just south of Copenhagen, for the purpose of constructing a landing place for aeroplanes and hydroplanes.

British Aircraft Imports and Exports

For the month of September the imports of aircraft amounted to £386 and the exports to £302,802. For the first nine months of the year the figures were £833,091 and £1,576,189 respectively, which compares with £2,325,885 and £460,866 in the previous year.

A Seaplane Honeymoon in Peru

Up-to-date ideas prevail in the matter of weddings at Lima, Peru, evidently, as it is announced that after the marriage on October 12, of Major Sison, an air officer, attached to the Peruvian War Ministry, and Señorita Rosita Porras, a niece of the former Chancellor, the bride and bridegroom started on their honeymoon in a seaplane, bound for Ancon.

German Aviators Boycott Foreign Capital

A Berlin correspondent reports that the Aero Clubs of Kurhessen, Gross Thüringen and Saxony, have combined to form a national German aviation society. The inaugural meeting took place at Cassel in Prussia and was largely attended by delegates from many district councils and representatives of important manufacturing and commercial interests. It was unanimously resolved to adopt a resolution pledging the members to prevent by all possible means the investment of foreign capital in Grman air transport companies. The headquarters of the new Society are at Cassel, which city has already provided a landing place for German aeroplanes.

German Aviation Progress

The German Minister of Aviation has established an official Press Department for dissemination of International aviation news. Much satisfaction is being shown by German aeronautical engineers at this intimation of official interest in aviation.

The German Under Secretary of State for Air Transport has allotted a sum of 20,000 marks for the purpose of creating a lecturership on aviation at the Technical High School of Brunswick.

In German Aviation circles surprise is freely expressed at the importance attached to amphibian machines in England, which in the eyes of German aeronautical engineers are not looked upon as the flying machines of the future, although it is admitted that they may be extensively used in the Colonial air services.

American Embassy Adopts British Air Mail

Handley Page, Limited, have been notified by the American Military Attaché that all personal and other mails from his office at the American Embassy in London to any point on the Continent are now dispatched by air, with the sole exception of such communications as it is necessary to forward by the Embassy Courier.

South African Aviation

Two owners of aeroplanes have signified their intention of putting in tenders for the conveyance of mails between Franklin and Maclear, via Cedarville and Matatiele by air, but, adds the "Matatiele Mail," the Surveyor of Posts and Telegraphs is opposed to the conveyance of mails from Franklin to Matatiele, via Kokstad, and also by aeroplane.

The filming from the air of the Victoria Falls, from the aeroplane "Rhodesia" has been very successful. Like the crew of the "Silver Queen," Messrs. Rutherford and English cannot speak too highly of the wonderful view to be obtained of the Falls from the air. One gathers from the pilot's narrative of the tour that viewing the Falls from the air is a habit which grows on one, and he says he enjoyed every single trip over the river. That part of the trans-Rhodesian route between Wankie and Livingstone was about the worst flying portion of the tour. The bush is so dense and continuous that emergency landing places are practically non-existent. The view of the ground, however, is a wonderful one—the "Rhodesia's" crew describe the country as looking for all the world like a genuine Persian carpet, patterned with strips of evergreen bush. The trip as a whole served to show that practical commercial flying in Rhodesia is a sound proposition.

Paris-Prague Service

There is now a regular air mail service running three times a week between Paris-Strassburg-Prague. Departures from Paris take place on Monday, Wednesday and Friday, and from Prague on Tuesday, Thursday and Saturday. The whole journey takes six hours, allowing for a stop of half an hour at Strassburg, where a change of aeroplane is made.

The machines employed are the S.E.A.H. Potez, equipped with the Lorraine-Dietrich motor of 375 h.p. The passenger tariff between Paris and Strassburg is 500 francs single, 800 return. Goods are carried at 10 francs a kilo. The Paris-Strassburg service is a daily one, and it is hoped to make the Strassburg-Prague a daily one, too.

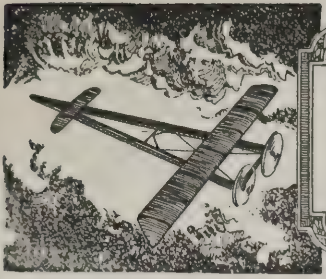
Air Companies Operating from Paris

The table of times and fares of the various air transport companies operating from Paris, published last week, was inaccurate in one respect. The entry to the name of Handley Page Transport, Ltd., should have read: "Departures from Paris daily at 12 o'clock."

Freight rates 1s. 3d. per lb. to 100 lb. and 1s. per lb. above that. The *ad valorem* charges are 1 per cent including insurance. Single passenger fare, £10 10s.; return, £18 18s.; which includes conveyance to and from the aerodromes by the company's cars free and 30 lb. passenger luggage carried by air.

Aeroplanes for India

A Reuter message from Simla states that the Government of India has received a gift of 100 aeroplanes from the Imperial Government. Some have been given to the local Governments, while others have been offered to ruling princes, and twenty have been made over to the Royal Air Force. The remainder will be offered to aero clubs, R.A.F. officers resident in India, or to companies prepared to establish aviation schools. The machines will be handed over free of charge at Karachi, on condition that they are used for purposes of demonstration and instruction, and are not sold to third parties.



ELEMENTARY AERONAUTICS
and
MODEL NOTES

By John F. McMahon

A Speed Model Aeroplane

THE model shown in the accompanying drawing in this issue is what is known as a SPEED model, and some have been known to travel at speeds greater than 50 miles per hour. In fact, one designed by the writer, which was exactly like the drawing, and used in a speed contest held at Van Cortlandt Park about four years ago, travelled at the rate of 55 miles per hour.

These speed contests are held over a measured piece of ground one-tenth of a mile long, and the model must pass each point—that is, the starting and finishing lines—in order to be officially timed.

It is a very hard thing to control these models, as the least little change in the wing surface or even a slight resistance on one side will make the model turn in a circle. I have seen model after model started in these speed contests and never reach the finish line, although they would cover much more ground travelling in circles than would be necessary in the straightaway distance.

Although the model in the drawing looks out of proportion and awkward, it is a very fine looking machine in the air, and the model builder is well paid for his work by the flights and the enjoyment he gets out of it.

These differ to the long distance models inasmuch as one need not travel as far to bring the model back after each flight, and, again, four sets of rubber are needed to complete the model.

While a speed contest will not be included in the coming contests, it would be well for models clubs who intend conducting a set of flights for prizes to include a speed contest on the program, and I am sure that it will be the closest contested and most enjoyed of the program.

The expense of building a model of this kind is very low and one can be constructed from parts saved from wrecked long distance models.

To construct the model proceed as follows:

Make the frame first of ¼ x 3/16″ spruce 30½″ long. The ends of each longeron is tapered slightly and fastened together with thread and glue forming the apex of a "V." This frame is known as an "A" frame and is the strongest known for model construction. A piece of spruce ¼ x ⅛″ and about 17″ long is given a stream-line shape and fastened across the main longerons at a point a few inches from the rear, as shown. This becomes the hanger for the outside propellers. This spar must be braced at the ends with a piece of bamboo running from the ends of the spar to the longerons. This takes up the pull of the rubber motors. Bearings made of 1-32″ I.D. brass tubing about ⅜″ are soldered to strips of brass and fastened to the ends of this spar. Two more bearings made of a piece of tubing with a copper washer soldered to each and fastened by inserting into a block of wood are fastened to the ends of the longerons, on the top side. These bearings are for the inside propellers.

The propellers are of the low pitch type and are 8″ in diameter. There are four in number and all are pushers.

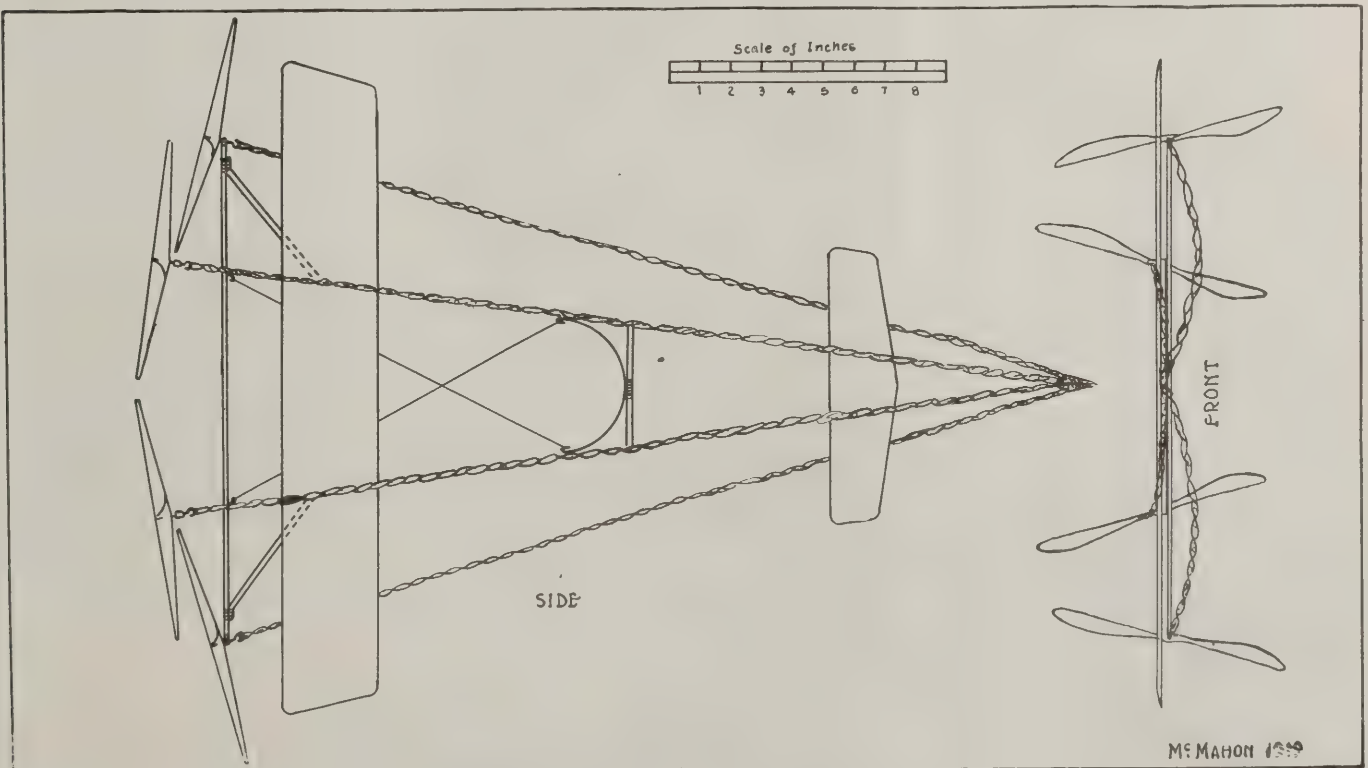
The best way to make the wings is to procure a piece of white pine or clear spruce 3/16″ thick, 3 x 22″, and sandpaper one side to a smooth finish. This side is the under side of the wing. The top should then be shaped to a true wing shape and sandpapered to a smooth finish, as before. Then two coats of shellac should be applied. In order to keep the wings from splitting many model builders glue silk to the under side of the wings and after drying press it with a hot iron. Then shellac or a varnish made of *Ambroid* glue diluted with acetone or banana oil is applied to give it strength.

The wings should be fastened on to the model with rubber bands to allow free movement forward if the model should strike the ground forcefully.

The balancing of a model of this kind is very difficult, and it requires patience and many tryouts before the correct balance is found.

The proper way is to wind the rubbers up to their full capacity, and have the main wing about 2″ away from the first or outside set of propellers. The elevator should be up to about 4 inches from the apex of the "V" and should have the front edge elevated about ¼″ higher than the trailing edge.

When the model is released it will be easily seen whether the model is corrctly balanced or not, and it will be protected from pitching nose first to the ground.



High speed rubber powered motor described above

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

At the Mechanics' Boarding-house

"Make yourself ready for dinner, Si."

"We aintta goin' t' eat, be we?"

And the shade of Francis Bacon, alias Will Shakespeare, stirred uneasily in its wooden kimono.

Military Chatter!

"I got two checks from home this month," said the exhibition flyer.

"'Snothing," said the circus performer, "I got two checks and a serious repulse right in this village."

Minister—Young man, do you know the price of the pursuit of pleasure?

Blacksheep, Jr.—Yes, sir! Thirty cents the first mile and ten cents for every half mile after that.—*Lampoon.*

The following conversation took part between two aviators interned in Germany:

"How's come only the boys do that goose-step?"

"Why, you fool! Would you expect a chicken to walk like a goose."

Pilot to waiter—Is that butter good?

Waiter—Our butter speaks for itself.

Pilot—Well, if it is old enough to talk I don't want it.

A Call Down

"Listen; it's airy verse:

Johnny in his aeroplane,
Said, "I'll sail the sky,
Hi! hi! I'll have a high old time.
high."
on
up
me
hie
I'll
But Johnny married (as men will)
Hypatia, known as Hy.
She had a temper like her name
And fire in her eye.
She made John sell his aeroplane—
He feared Hypatia so;
He ne'er again will soar the sky—
He's
feeling
awful
low."

Terse Terms

Slone—I hear they call Mire's flying machine a lover's machine.

Loan—Why so?

Slone—Its two cylinders beat as one!

Warned

"You say you are a pacifist?" asked an aero manufacturer.

"Yes," replied the indignant person, "and let me tell you, sir——"

"Hold on a minute."

"Well?"

"If you are pacifist, don't shake your fist at me."

He Knew

Visitor (to aeronautical enthusiast in one of New York's libraries)—Do you know where I can find Lincoln's Gettysburg address?

Enthusiast—Just send it to Gettysburg and he'll probably get it all right—*Jack-o'-Lantern.*

A Sociable Chap

An aviator who has traveled throughout the United States filling exhibition dates relates the following conversation which he overheard while in Washington.

There entered a Washington shop a dusky person who announced that he wished to purchase a razor.

"Safety?" asked the clerk.

"No, suh," was the decided response, "I desires it fo' social usage."

After the Meet

"How did you get that stitch in your side?"

"Oh, I got hemmed in a crowd."—*Lampoon.*

True love is like an aeroplane—uplifting—and then you fall hard!

"Good morning; have you used Pear's soap?"

"No; I'm not rooming with Pear any more."

So It Goes

"Jimson mortgaged his house to buy an aeroplane."

"Yes, and now he's got to mortgage the aeroplane to buy gasoline."

"The need of an efficient stabilizer is strongly felt."

[Recent committee report on aeronautics.]

AERIAL AGE WEEKLY

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The Naval Academy at Annapolis

Photo U. S. Army Air Service

Air Lines and Finances

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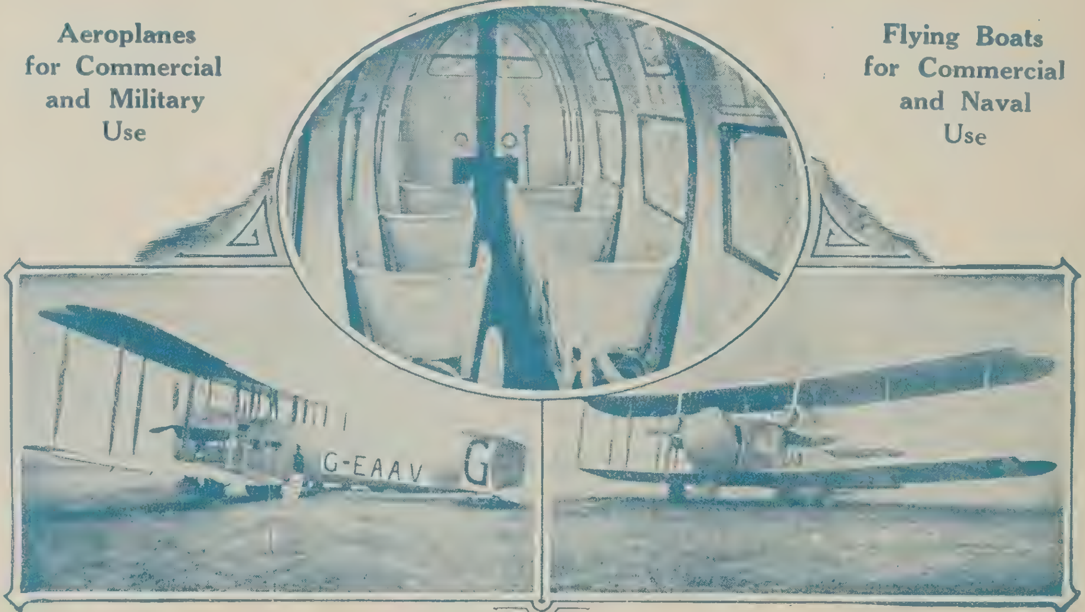

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AIR LINES AND FINANCES

AVIATION cannot be done satisfactorily on the cheap. Organization and personnel of air lines must be of the best, at least as good as that for handling rail-borne traffic.

There has not been a great disposition to put out much capital on commercial aviation on the part of firms who did well in the War. Perhaps these firms have not made such huge profits as some people are disposed to imagine, and if they did the Treasury Department is seeing to it that a good share is coming back to the Government through the channel of the Surplus Tax.

Some people seem to have the impression that all that has to be done is to buy a few old war machines cheap, hire some pilots in much the same way and at the same wages as chauffeurs, obtain some tools, etc., on credit, and, presto, you have an air line. But the organizing, equipping and operating of an air line is not quite such a simple business as that.

To start with, the aeroplanes should be especially designed for the purpose, and they should have reliable engines, for unless a large "useful load" can be carried the service cannot be made to pay. The planes must be fast, and at the same time able to land in a confined space, and for carrying passengers, must be luxuriously furnished. The pilots, besides being skillful, must be highly experienced cross-country fliers and well acquainted with navigation. Then there are the engineers, mechanics and repair shops, and the indispensable office organization. Another vital matter in air navigation is rapid communication between aerodromes, or between aerodrome and plane, and for this wireless must be used. Most important of all is the provision of landing fields with organization for supplies at frequent intervals along the route. And finally there is the matter of handling mails, express packages and passengers at either end, in which matter air transport companies are usually handicapped by the fact that the aerodromes are further from the centers of population than are railroad stations, and it appears inevitable that this should be so for some time to come at least.

It is the duty of the Government to assist those who invest in air transport companies by subsidies for air mails and by the provision of landing grounds and means for the aviator to find his way. The providing of these is as much a duty to the community as is the providing of good roads and the support of the aeronautic industry is a form of assurance for national security.

We have used the word subsidies, though it has been objected to in some quarters as a word open to misunderstanding, because it suggests aeronautics requires charity from the Government. Most emphatically we do not mean this. The air lines are capable of returning adequate service for all payments made to them. But in order to put them on a paying basis, they must be guraanteed by the Government some permanent and sufficient remuneration which should not be dependent on the erratic fluctuations of the amount of support from the public forthcoming to a new service. All the air lines require is the guarantee of a reasonable paying load on any journey they make.

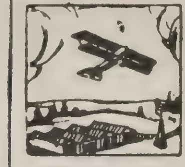
The Promise of the Helicopter

IN this issue of Aerial Age we present the first authoritative discussion of the Hewitt-Crocker helicopter, which will provoke earnest thought on the part of aeronautic engineers. Hitherto the helicopter, or direct-lift aircraft, has been the domain of experimenters almost universally regarded as cranks, but during the last year such serious thought has been given to the subject as to compel the interest of aeronautic experts.

In France substantial governmental co-operation has been given to M. Demblanc in his experiments, and it has been known that the British and Italian governments have been experimenting with helicopters for over a year.

The results obtained by Dr. Hewitt and Professor Crocker are remarkable and throw considerable light on the problem of making a passenger carrying helicopter. The problems of steering and stability are purely mechanical, and it has been found that a very slight divergence from the horizontal plane of rotation is sufficient to secure forward speed, direction being determined by rudder.

The results secured by Dr. Hewitt and Professor Crocker thoroughly justify further experiments, and we hope they will be carried out without delay. May they be the first to demonstrate practically the passenger carrying possibilities of the direct-lift aircraft!



THE NEWS OF THE WEEK

Fokker Arrives in America

Anthony H. G. Fokker, inventor and manufacturer of the Fokker airplane, arrived on the Holland-American liner Noordam November 10.

"I am out for business all over the world," Mr. Fokker said before landing. "Air transport is of the greatest international importance and its possibilities have to be studied everywhere. I have my eye not only on transcontinental traffic but, on transoceanic service as well."

The problems which the thirty year old inventor is giving special attention to at this time are the establishment of a transatlantic air service, the building of a special monoplane which will carry the entire mail service between London, Brussels, Hamburg, Copenhagen and Berlin and the possibility of utilizing an energy which he says is known to be in the air to replace engines as the motive power for aeroplanes.

"Wind and bad weather no longer trouble us in the air," Mr. Fokker continued. "Flying with certainty in the air will be made easy by the development of directional wireless, and our aeroplanes will find their ports by the use of it, in the same manner that liners now do by their submarine signals."

In Mr. Fokker's party on board the Noordam, which included Mr. Fokker's secretary and Mrs. Fokker, was Robert B. C. Noorduyn, who made planes for England during the war, and who is now associated with the Dutch inventor in his aviation projects.

Mr. Fokker will make his New York Headquarter at the Waldorf-Astoria.

Balloons Will Direct Seal Hunters to Herds

St. John's.—Two dirigible balloons presented to Newfoundland by the British Government are to be used this winter to locate seal herds. They will work in conjunction with sealing steamships. Air reconnaissance in seal hunting, Government officials say, will give impetus to the trade of the country.

Aero Club of New England Dinner

The annual dinner of the Aero Club of New England will be held at the Boston City Club on Monday evening, November 22, 1920, at 6.30 o'clock. There will be distinguished guests and speakers present.

Landing Field at Greenville, S. C.

Moss E. Penn, Secretary of the Young Men's Business League, informs us that there has been established at Greenville, S. C., a landing field with proper facilities for cross-country fliers. The field is located one mile east from the center of the city and is marked with a cross.

The field is open to all pilots and the Greater Greenville Association, which is operating the field, will render every possible assistance to visiting airmen.

40 Planes Will Race for Pulitzer Trophy

Forty or more aeroplanes, all with speeds in excess of 100 miles an hour, will compete on Thanksgiving Day in the Pulitzer trophy race, which begins and ends at Mitchel Field, Mineola.

Eighteen army planes and eight navy planes already have entered in the contest, which is of 160 miles, in addition to civilian entries, which include the American Gordon Bennett "ships."

The race, for the trophy, donated by Ralph Pulitzer, is to be an annual affair. Nearly $4,000 in Liberty bonds will be awarded to winners in various classes. The course is a triangular one of forty miles, with turns at Wantagh, Babylon and Mitchel Field.

Planes for Members Kept by London Club

There is a club in London which offers its members the pleasant diversion of making an aeroplane flight whenever they please. It is the Royal Aero Club. It has purchased six flying machines for the exclusive use of its members, most of whom are air pilots.

The aeroplanes are kept in hangars at Cricklewood. A charge of $25 an hour is made for the use of a machine. This covers the cost of petrol, insurance and pilot.

Air Motor Americanized

The Hispano-Suiza motor, manufactured for two years or more in this country by the Wright Aeronautical Company, has been so "Americanized" as the result of improvements added in this country that it will hereafter be known as the Wright motor, it is announced.

"The aeronautical engine which we are building to-day is no more the Hispano-Suiza than the Liberty or Rolls-Royce engine is the German Mercedes," F. B. Rentschier, vice-president of the company, said in announcing the change.

The "Hisso," as flying men call the motor, is famous as the engine which made it possible for American and allied aces to combat on equal or better terms the fighting Fokkers of the Germans. It was used in the Spad and ST-5 chasse machines.

Air Tourists Are Numerous

That Pasadena will be one of the most important centers of commercial and pleasure flying during the winter months is indicated by the early activity which is taking place in the Crown City.

The municipal field, at Altadena, which was formerly occupied by the Mercury Company, will be used during the next few months by A. H. Hayes, a wealthy Pasadena flying enthusiast, as a private field for his own plane, and with the expectation of utilizing it as a club field for any other privately owned plane which may be brought there during the winter.

Frederick Whitney, one of the best known of local aviators, will be in charge of the aerodrome. Hayes has recently purchased a new Standard plane, equipped with a Hall-Scott motor of Liberty design, which will be permanently operated from Altadena.

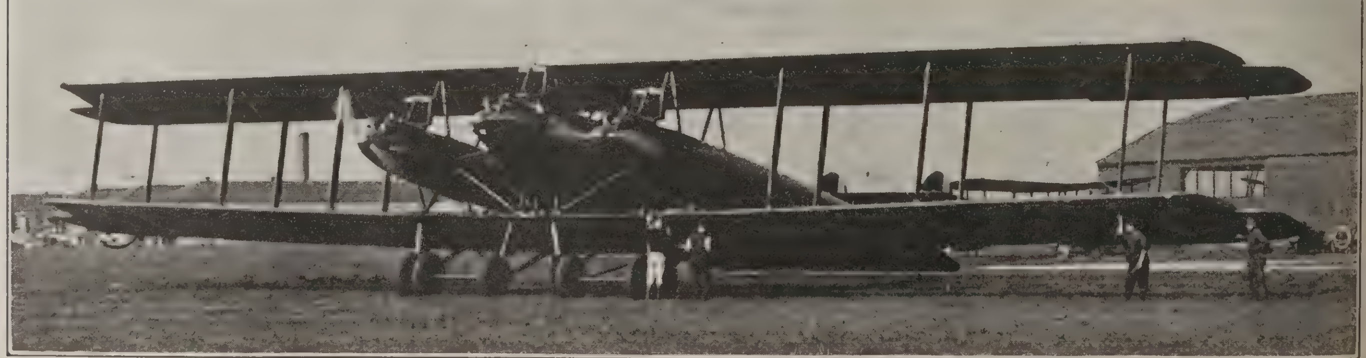
Special Sunday exhibitions are already being staged at the Sierra Field, consisting of a mimic aerial combat, carried out by former service pilots. The early rush of Easterners is indicated by the crowds that have assembled to witness the sham battles.

G. E. Barnhart, who has designed and built many successful planes is completing a large twin-motored machine after his own plans, which will be tested in flight within a month or six weeks.

As a result of the growing popularity of flying in Pasadena, it is reported that several Pasadena merchants, two of whom own chains of stores in a number of Pacific Coast cities, are planning to purchase planes for traveling between the cities in which their interests are located.

Fast Time in Fokker

Flying the Hall-Scott equipped German Fokker, Frank Clark recently flew from Durant Field, Oakland, to the Venice Field in three hours and forty-five minutes' flying time. An interesting feature of the flight was that Pilot Clark had never flown this or a similar machine before, but nevertheless took off without any hesitation, made one circle of the field and was off for his destination. The day following his arrival at Venice Mr. Clark gave the visitors at both the Venice and Chaplin Fields an exhibition of stunt flying that only the combination of Clark and a Fokker could make possible.



The L.W.F. "Owl" which was built as a bomber, but will now be used for mail and freight. It is equipped with three Liberty motors

Crew in Training for Aeroplane Ship

Mitchel Field, Long Island, has taken on a decided atmosphere of the sea since the cutting down of the army air forces made room for the navy, which has moved in and has a contingent in training to fit a nucleus crew to form the complement of the new aeroplane ship Langley.

It is expected the converting of the Langley, formerly the Jupiter, will be completed in time for the vessel to take part in the winter manoeuvres of the Atlantic and Pacific fleets when the mobilization at the Pacific end of the Panama Canal takes place. The navy is building another aeroplane ship, the Wright.

This will be the first time aeroplane ships will have taken part in the war game of Uncle Sam's great fleets, although scout and battle planes have figured in them at Guantanamo, but always flying from a runway on the big guns of the battleships themselves.

The Langley will have a runway for planes of the land type, more than 500 feet in length and taking in the whole width of the ship. There will be no obstruction on the spacious deck, even the stacks and the ventilators will emerge clear of the runway. The lookout stations and bridge will be beneath the landing "field." In the body of the vessel will be a great machine shop, with many repair departments and assembling rooms for planes. The Langley has the distinction of being the first electrically driven ship in the navy. She is of 20,000 tons displacement, 542 feet long, with a beam of 65 feet. During the war she was used as a collier.

At least three types of land machines will be used on the Langley, and possibly two types of seaplanes. At present at Mitchel Field there are four De Haviland 360 horse-power Liberty motors, land planes, dual controlled; eight Vought 180 horse-power Wright motors, dual controlled; four Curtiss JN-6 150 horse-power, dual controlled, and two English SE-5 single seaters, equipped with Colts and Marlin guns.

There are twenty officers, fifteen chief petty officers and about 160 enlisted men of less rating in the navy contingent under training for the Langley.

Flight of Seaplanes to Panama Decided Upon

After being several times postponed because of the tremendous difficulties involved, the great Panama flight, as tentatively announced some weeks ago, has been definitely decided upon. For a time it was even rumored that the several flying squadrons, composing the greatest seaplanes so far designed for warfare over the ocean, would fly as far south as Chile, where the combined American fleets will meet for their annual battle manoeuvres. But the rumor never received any sort of confirmation, since a trip over twice the distance of Panama would be quite out of the question, by reason of its great cost as well as distance. The flight to Panama in itself will be one of the greatest undertakings ever attempted by aircraft.

The long flight will commence shortly after the first of the new year. Three of the famed NC's of Trans-Atlantic experience, will lead the several aerial squadrons, composed of the F5L type of seaplanes. The U. S. S. Aroostook, mothership for the Fleet planes, and the converted destroyer Mugford, will carry sufficient fuel for the planes on the long trip.

It is the opinion of airmen who will make the trip, that the entire distance can be covered in from eight to ten hops. When refueling of the planes is necessary, they will make a landing at sea near the fueling ships. Any repairs that may be required will also be made at sea, insofar as possible.

The greatest of interest is being manifested in aeronautical circles over the impending flight.

New Marshfield Company

The Coos & Curry Airplane Company has been organized in Marshfield, Oregon, to engage in passenger carrying and commercial work.

Dr. Leslie G. Johnson is President of the Company, William Emerson, Vice-President, L. H. Evans, Secretary & Treasurer, L. M. Briggs, General Manager, J. N. Case, Assistant Manager.

Aged Squaw Makes Flight

Leon D. Smith, who has been undertaking exhibition work at various state fairs, had an interesting experience at Batavia, N. Y., when he initiated into the joys of flying Nancy Miller, an Indian squaw of 106 summers. The fair passenger enjoyed her trip thoroughly.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, August, 1920

													SERVICE AND UNIT COST						
DIVISION	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	Gallons of Gasoline	Total Time Run hr.	Total Time Run min.	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
New York-Washington	$2,623.34	$381.85	$1,284.32	$771.65	$375.46	$617.52	$775.15	$3,473.66	$2,398.72	$967.51	$522.13	$14,191.31	8,069	347	10	27,588	3.4	$40.87	$0.51
St. Louis-Twin Cities*	1,051.29	268.07	536.76	395.05	34.10	772.38	1,672.65	2,348.30	1,016.14	482.24	321.31	8,898.29	2,869	177	07	12,665	4.4	50.24	.70
New York-Chicago	6,403.16	1,120.45	2,511.74	1,595.17	545.64	1,331.98	4,868.55	4,700.83	4,487.53	3,190.62	2,088.51	32,844.18	19,284	610	40	44,780	2.3	53.78	.73
Chicago-Omaha	2,913.94	461.37	832.94	572.01	126.18	262.18	2,594.40	2,638.24	2,214.73	488.30	1,036.23	14,140.52	8,220	286	05	26,370	3.2	49.42	.54
Omaha-San Francisco** (Trial Flights)	516.23	134.59	476.73	72.95	....	180.59	610.16	479.99	164.19	108.35	208.85	2,952.63	1,370	56	48	4,620	3.4	51.98	.64
Totals and Averages	$13,507.96	$2,366.33	$5,642.49	$3,406.83	$1,081.38	$3,164.65	$10,520.91	$13,641.02	$10,281.31	$5,237.02	$4,177.03	$73,026.93	39,812	1477	50	116,023	2.9	$49.41	$0.63

Planes operated on New York-Washington Division:
  Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
  Curtiss R4, equipped with Liberty 12 motor.
  Curtiss HA, equipped with Liberty 12 motor.
  Curtiss JN4D, equipped with Curtiss OX5 motors.
  De Havilands, equipped with Liberty 12 motors.
  Dual De Havilands, equipped with Liberty 12 motors.
Planes operated on St. Louis-Twin Cities Division:
  Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
  Twin De Havilands, equipped with two Liberty 6 motors.
  Dual De Haviland, equipped with Liberty 12 motor.
Planes operated on New York-Chicago Division:
  Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
  Curtiss R4, equipped with Liberty 12 motors.
  Curtiss HA, equipped with Liberty 12 motor.
  De Havilands, equipped with Liberty 12 motors.
  Dual De Havilands, equipped with Liberty 12 motors.
  Twin De Havilands, equipped with two Liberty 6 motors.
  Martins, equipped with two Liberty 12 motors.
  Junkers (J. L. Larsen), equipped with B. M. W. motors.
Planes operated on Chicago-Omaha Division:
  Standard, equipped with Hispano-Suiza motor.
  De Havilands, equipped with Liberty 12 motors.
  Dual De Havilands, equipped with Liberty 12 motor.

Planes operated on Omaha-San Francisco Trial Flights:
  De Havilands, equipped with Liberty 12 motors.

Note: *Service inaugurated August 16, 1920.
**Service not inaugurated—trial flights.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington..............	$0.14	$0.14	$0.23
St. Louis-Twin Cities................	.14	.23	.33
New York-Chicago..................	.22	.28	.23
Chicago-Omaha......................	.12	.23	.19
Omaha-San Francisco (Trial Flights)..	.19	.27	.18
Entire Service..........................	$0.17	$0.23	$0.23

OTTO PRAEGER, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Aerial Express Co. Incorporated in Ohio

Election of Directors and Officers in the United States Aerial Express Co., an Ohio corporation, took place November 4th, and the following business men of Cleveland were elected as directors: Thos. H. Nash, Dan R. Hanna, Jr., Thomas F. Dunn, Walter C. Baker, Geo. W. Talkes, J. M. McIntosh, and A. H. Denison.

As officers: President, Thomas H. Nash; Vice-President, George W. Talkes; Treasurer, J. M. McIntosh; Secretary, Arthur H. Denison; General Manager, Thomas F. Dunn.

The action taken by the board immediately after election is of vital interest to the business men of Ohio and Michigan in the establishing of an aerial transportation service between Cleveland and Detroit, operating giant hydroaeroplanes and auxiliary aircraft in the transportation of mail, express and passengers. The charter of the United States Aerial Express Company covers the operation of aeroplanes, hydroaeroplanes and balloons for commercial transportation. Consideration was given and tentative plans laid for the expansion of its business to cover all parts of the United States, the Pacific Coast, the Gulf States and the Hawaiian Islands.

Preliminary work to decide the advantages of the type of aircraft to be used was carried on both at Cleveland and on the Atlantic Coast for the past several months, to give a basis at reaching costs of operations, possibilities of business to be had and the demand for such a method of transportation because of its speed and as a means of saving time.

In the Cleveland-Detroit service, two or more round trips daily, excepting Sunday, will be made. Planes will leave on schedule both in the morning and in the afternoon from both ports. Other planes will be held in readiness for special service, charter or sightseeing trips.

Passenger and express rates are divided into three general classifications. U. S. Mail and package express (insured and bonded), general merchandise and passenger travel. Under the first classification rates will be determined on the class and valuation. The second classification, general merchandise covers everything from ten pounds to one ton. Passenger travel is self explanatory.

It is intended to commence operations shortly and service will be maintained on schedule regardless of weather conditions or seasons. This will be possible by the use of different kinds of aircraft for the work.

Adcox Aviation School Active

The Adcox Auto and Aviation School, Portland, Oregon, has outlined ambitious plans for their aviation courses. The personnel which the management has secured insures excellent tuition in the various branches of practical flying.

The staff includes: Victor Vernon, L. L. Adcox, Lieut. L. B. Hickam, Howard C. Charlton, F. E. Harding, N. E. Meyers, Sergt. F. M. Rush, W. L. O'Neil, H. L. Thomas, Lieut. Archie F. Roth.

To Operate Chaplin Field

It is rumored that the Chaplin Aviation Field at Hollywood will be in operation within the month under new management.

Pacific Sales Plan

A sales campaign has been prepared by the Pacific Airplane & Supply Company and is being developed this winter. State rights for the Pacific Standard planes in five models and spare parts for both planes and motors are being let to state distributors; contracts covering five states with orders for demonstrator machines are now in the hands of the Pacific Airplane & Supply Company.

Not only is the activity of this concern confined to the United States. Negotiations are being conducted at present for the distribution of Pacific Standard plants in Costa Rica, Colombia, Peru and Chile.

Thos. F. Hamilton, of the Hamilton Aero Mfg. Co., and two passengers about to take off for Chicago. Two propellers as well as baggage are carried in rear compartments. This company delivers propellers to air mail stations by aeroplane

Modesto Municipal Field

The city of Modesto, California, dedicated its municipal landing field on November 11.

Twelve years ago Modesto adopted a new charter and in the provisions of the charter for public works was aviation landings. At that time such a provision was considered a joke, but now that aviaton has come to stay, it has been put to practical use and last spring bonds were voted for the purchase of an aviation field. The field is now complete and is in shape to handle any kind of aircraft. Captain Reid, formerly of March Field, and Lieut. Harold Cocee, both well known in aviation, are on the committee which has charge of the dedication, and were active in laying out the field.

Personal Pars

Mark Campbell, aerial daredevil, has completed his eastern stunt contracts and has returned to Los Angeles with a trunk full of newspaper clippings and an Irving Chute packed in his suit case.

L. E. Benoit has returned from an extended trip in China and Japan and reports a considerable amount of commercial flying in these countries. Mr. Benoit states that the Hong Kong Flying School is operating thirty-five ships and are paying $900 gold per month for instructors.

Walter Hempel, show manager of the Manufacturers' Aircraft Association, is in Los Angeles to complete plans for a big national aircraft show to be held in this city during the winter.

Ed. Hubbard, formerly civilian instructor at Rockwell Field, and associatd after the war with the Boeing Airplane Company of Seattle, has been awarded a contract by the Government to carry mail from Seattle to Vancouver, B. C., by seaplane.

M. R. Riddell is now assistant to the director of the Engineering Experiment Station and assistant professor of aeronautic engineering at the University of Illinois, Urbana, Ill. He previously held the position of chief engineer of the Canadian Aeroplanes, Ltd., Toronto, and when that firm ceased operations engaged in private consulting engineering work.

Walter A. Toepel has resigned as engineer in charge of the experimental laboratory of the Splitdorf Electrical Co., Newark, N. J., and has been made an instructor in the Stewart Automobile School, Broadway and Fifty-seventh Street, New York City.

A Shower of Candy

Beautiful Miss Naoma piloted by Earl Daugherty, recently showered Los Angeles with a quantity of the famous Naoma old-time candy. Miss Naoma is enthusiastic over aviation, and is at present taking a course of instruction with Earl Daugherty at Long Beach.

THE HEWITT-CROCKER HELICOPTER

By Professor FRANCIS BACON CROCKER

THE helicopter is an air craft which supports, lifts and propels itself directly by the thrust of propellers. Its wings and propellers are one and the same thing, performing all these functions like the wings of a bird.

The helicopter idea is very old. Leonardo da Vinci 400 years ago actually made a sketch of such a machine. Many attempts to build one have been made but the results were so unsatisfactory that aeronautical authorities thought this type impracticable. This disfavor has no scientific basis and is largely a remnant of old fashioned prejudice against "flying machines". The fact being that the helicopter for general as well as special aerial service will surely rival or outrival the balloon and aeroplane because it has many important advantages over both.

Although the idea is so old, there are no very early patents on helicopters because until about fifty years ago the U. S. Patent Office would not allow an application for patent on aeroplanes or helicopters to be filed because it was generally thought that a practicable heavier-than-air flying machine was an impossibility like a perpetual motion machine. The first U. S. Patent for such an aircraft was granted to Edwin Oaks for an "Aerial Car" August 30, 1870, No. 106,862. In the fifty years since then, up to January 1, 1910, a total of 291 U. S. Patents had been granted being divided by the Patent Office into the three classes of "Helicopters", "Balloon Helicopters" and "Aeroplane Helicopters".

Most of these patents set forth constructions that are puny, crude, complicated or actually grotesque. It is astonishing how little these 291 U. S. Patents issued prior to January, 1920, contributed to the solving of the problem. Not only are there these many American patents but very numerous foreign patents, articles in journals and records of experiments on helicopters. Nevertheless all of these patents, articles and experiments failed to solve the helicopter problem even partially. In fact these attempts have been so far astray that they had a discouraging effect and undoubtedly delayed the production of a successful helicopter.

Inventors and investigators made the mistake of endeavoring to provide for various contingencies, supposed characteristics, accidents, etc., and overcome imaginable difficulties that they attributed to helicopters, instead of solving the real problem. This problem is to produce a sufficiently strong engineering structure with adequately powerful motors and having propellers of large enough diameter to give the lift necessary to raise the total gross weight of a full size working machine and have a good margin of load-carrying capacity for aviators, passengers, fuel, etc.

Many of the supposed difficulties are greatly exaggerated, if not imaginary. For example, the obtaining and control of horizontal motion are largely bugbears. Tests of models large and small, carefully made or crudely made, always indicate very rapid and very stable horizontal motion when the axis of the propellers is tilted through even a small angle of 5° or 10°.

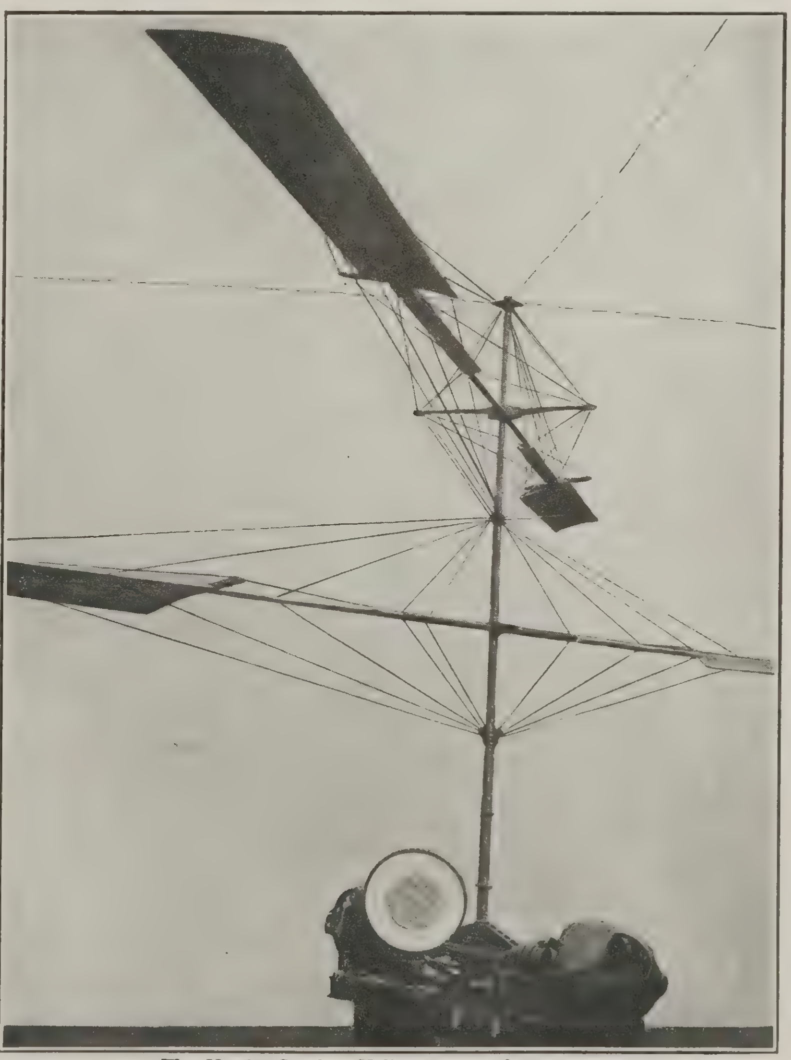
A full size working machine known as Helicopter No. 1 was designed, constructed and tested by Dr. Peter Cooper Hewitt and the writer. This helicopter is shown in elevation in Fig. 1, part of the fuselage or car being broken away. Fig. 2 is a general plan view. Fig. 3 is a vertical section of a propeller blade on the line 3-3 in Fig. 1. Fig. 4 is a vertical section through the axis of the propeller shafts showing in detail the construction of their lower portions also of the gearing and gear case. Fig. 5 is a diagram showing horizontal and vertical forces obtained when the propeller axis is tilted.

Helicopter No. 1 comprises an upper propeller 1 revolving in a normally horizontal plane and a propeller 2 revolving in a parallel plane 7 ft. below. Each propeller is 51 ft. in diameter. Propeller 1 is carried by a normally vertical shaft 3 passing concentrically through the tubular shaft 4 of propeller 2. The shaft 4 extends through tube 5 which forms part of the frame 6 of the machine and is stationary with respect thereto. This frame carries the car 7, motors, etc. The shafts, frame, gearing and practically all parts except the propeller blades are of steel. The shafts 3 and 4 are driven in opposite directions by motors 8 and 9 of 100 h.p. each arranged one in front and the other to the rear of the shafts 3 and 4. Their driving shafts are in axial alinement longitudinally of the fuselage 7, and this axis intersects the axis of the propeller shafts 3 and 4 at right angles.

The shaft of motor 8 is provided with a beveled pinion 10, and the shaft of motor 9 with a beveled pinion 11. Each pinion meshes with a large beveled gear 12 secured to the shaft 4 above the pinion, also with a beveled gear 14 of the same diameter secured to the shaft 3 below the pinion.

Thus a balanced action is obtained in driving shafts 3 and 4, with substantially no thrust on the various bearings. Inasmuch as each moving part of the mechanism is acted upon by equal forces acting in opposite directions. Each of the gears 12 and 14 is acted upon on one side of its axis by pinion 10, tending to drive it in one direction, for example, forwardly referring to Fig. 1, while on the other side of its axis it is acted upon by pinion 11 tending to drive it in the opposite direction, or rearwardly in the case assumed. In other words, with the motors giving equal powers a true dynamic couple is obtained, causing rotation without lateral thrust upon the bearings.

Full speed of the motors is 1400 r.p.m. and 100 r.p.m. for the motors, hence a speed reduction of 14 to 1 is necessary. This gear ratio is so great that a large gear of 30 inches diam. and a small pinion a little more than 2 inches diam. are employed. A gear of such size and sufficiently light would be apt to spring out of mesh, especially as its teeth must be small because of the small pinion diameter. Hence each gear 12 and 14 is formed with a rigid ring portion 15, in which the teeth are cut, engaging the pinions 10 and 11, the ring portion 15 being supported by a flexible plate 16, secured to a hub 17. The gears are maintained coaxial by the ball bearing 18. The flexibly mounted gears 12 and 14 are



The Hewitt-Crocker Helicopter on the test stand positively held in mesh with the pinions 10 and 11 by rollers 24, supported from the frame of the machine and bearing directly upon the toothed rings of the gears 12 and 14 at the points where they mesh with the pinions.

Each propeller comprises two steel tubular arms 26 in alinement, each 2¾ inches in diam. and about 25 ft. long, carrying a blade 27. The arms 26 are mounted for movement about their longitudinal axes to permit variation of the pitch angle of the propeller blades. Each arm 26 is provided at its inner end with a circular flange secured, by bolts, to a vertical disk-like flange projecting from the corresponding propeller shaft. Each arm 26 has mounted thereon cross-braces or ribs 37, to which covering sheets of aluminum forming the upper and lower surfaces of the propeller blades, are rivetted so as to leave the outer surfaces smooth. The spacing between these ribs 37 decreases from the inner to the outer end of the blade, as indicated in Fig. 2, so that the blade may have more strength toward its outer end, where the air pressure thereon is greatest. Each rib is formed of sheet aluminum, and comprises a vertical web from the upper and lower edges of which extend integral flanges 28 and 29, the ribs being thus channel-shaped in cross-section. Each rib is also provided with a cylindrical integral flange surrounding the hole through which the arm 26 extends as shown in Fig. 3.

The propeller blades of Hewitt-Crocker Helicopters have the form of aeroplane wings, not only in cross section, as in Fig. 3, but also in aspect ratio and other proportions, as in Figs. 1 and 2. The actual section of the propeller blades of Helicopter No. 1 is Eiffel No. 63, the thickness of which is one-tenth of the chord. The width of a blade is 30 inches, being the same as the chord of its section, hence its thickness is 3 inches. This section and these dimensions are uniform throughout the length of a blade, which is 12 ft., but could easily be made to taper outward in chord or thickness or both. The blade length will be increased to about 17 ft. to obtain an aspect ratio of about 7 to 1, also to gain more lift and especially greater lift per h.p. without increasing the propeller diameter. On the other hand the portion of a blade extending inward nearly to the axis of rotation of the propeller would be ineffective, and for a certain distance from the axis the upward thrust obtained would be less than the weight of that portion of the blade at the low angular velocities employed. Hence the inner ends of the blades should be about one-third of the radius of the propeller from its axis of rotation. Each propeller of Helicopter No. 1 has a radius of 25.5 ft. one-third of which is 8.5, so that the blade should be about 17 ft. long, as already stated.

The area of a blade 17 x 2.5 ft. is 42.5 square ft., and for both blades of each propeller is 85 sq. ft. This area is 4.16% of the disk area of each propeller which is 2043 sq. ft., being 51 ft. diam. The total area of all four blades of both propellers is 170 sq. ft. or 8.32% of the disk area of one propeller which acts in practically the same area as the other one.

The center of transverse support and strength of a propeller blade substantially coincides with the axis of the tube 26, which is located considerably forward of the longitudinal center line of the blade, as in Figs. 2 and 3. This construction brings the center of support forward of the center of air pressure, which is usually about 20% to 33% of the width of the blade back of its front edge. Thus the blade is pulled around by the supporting arm, instead of being pushed, and danger of chattering of the blade is obviated. This blade construction and mounting gives sufficient yield in the blade to permit of automatic variation of its pitch by the air pressure, within desired limits. The speed of rotation of propellers varies greatly in starting or rising, in descending or landing and in various conditions of flight, and also depends upon the action of the motors, quantity and quality of fuel, etc. The greater this speed the smaller the pitch angle to give the upward thrust required to lift and support the machine.

It is generally desirable not only for the pitch of the propellers to adjust itself automatically for lift but also with respect to their drag or torque required to rotate them. At moderate speed a considerable pitch angle may not involve excessive drag or torque. At high speed, however, the torque may become greater than is necessary to produce the desired effect or greater than the strength and proper action of the parts will safely permit, so that decrease of pitch is desirable.

For turning the machine about the axis of the shafts 3 and 4, so as to enable it to face in different directions, planes 30 and 31 are provided, located at the extremities of the arms 32 and 33 respectively. These planes are capable of being tilted about a horizontal axis passing through their centers and are located below the propeller blades, so as to receive the down-draft therefrom. When it is desired to turn the machine about the axis of the shafts 3 and 4, the planes 30 and 31 are tilted in opposite directions away from their normal vertical positions. The result is that the down-draft from the propeller blades tends to cause the plane 30 to move in one direction and the plane 31 to more in the opposite direction, thereby producing a dynamic couple, tending to rotate the machine as desired. As soon as the machine has been rotated to the desired position, the planes 30 and 31 are returned by the operator to normal vertical position.

These planes may be used to correct any tendency of the car to rotate due to unequal action of the propellers. Many tests of Helicopter No. 1 in operation show that almost perfect balance is actually obtained. The same may also be arranged to rotate about vertical axes 30^1 and 31^1, for use as rudders to balance unequal effort of the propellers tending to turn the machine when it is in horizontal movement or planes used to turn the machine when it is moving horizontally.

For tilting the machine to produce lateral motion thereof, one of the planes 30 and 31 is moved to horizontal position, the other remaining vertical, whereupon the down-draft from the rotating propellers forces this plane downward. Independent means are desirably provided to maintain the machine tilted after it has begun its lateral movement. This is effected

Fig. 1

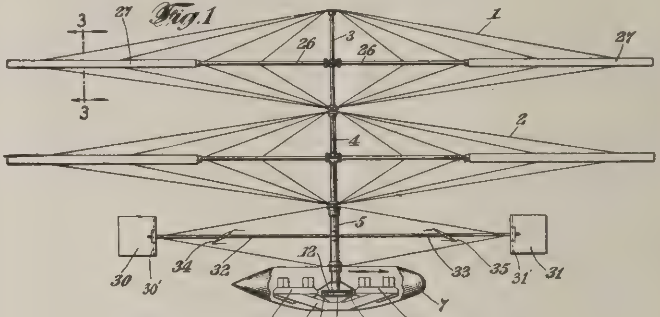


Fig. 2

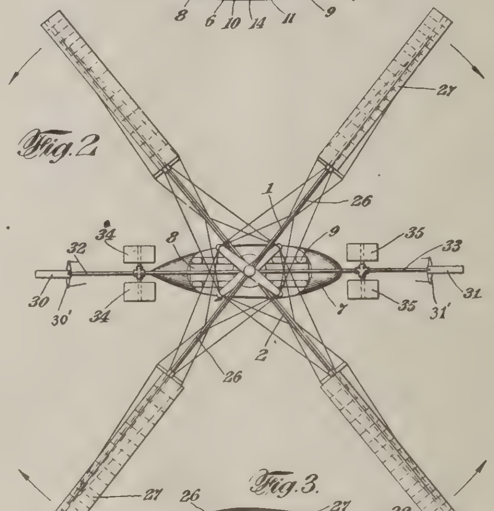


Fig. 3

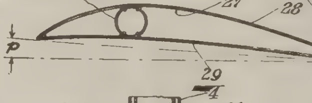
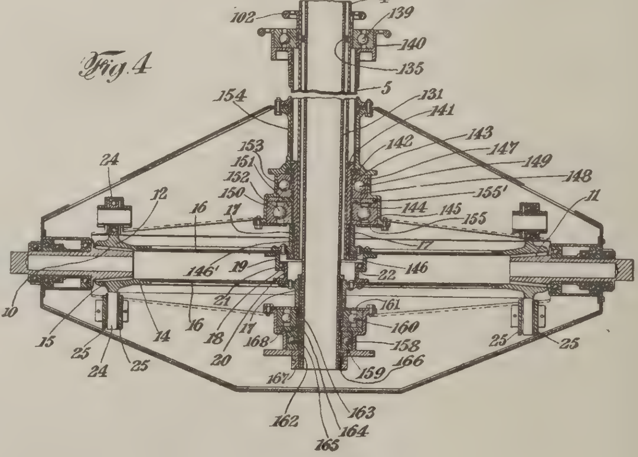


Fig. 4



by planes 34 and 35 carried by the arms 32 and 33, respectively, and rotatable about horizontal axes transverse to said arms. These planes are located inwardly of the inner edges of the propeller blades and do not receive down draft therefrom. By inclining them in opposite directions, as shown, the air will, if the machine moves forwardly in the direction of the arrow, press against the upper surface of the plane 35 and the lower surface of the plane 34, thereby keeping the machine tilted against its tendency to right itself.

(To be concluded)

THE DAVIS-DOUGLAS "CLOUDSTER"

THE Davis-Douglas "Cloudster" is an interesting biplane under construction in Los Angeles. The new plane, according to Mr. Davis, president of the company, is an absolutely standard design. According to its builders it will owe its efficiency entirely to refinements of design which result in lessened head resistance, lighter weight and better lift.

The "Cloudster" was designed by Donald W. Douglas, vice-president and general manager of the company, and one of the most successful aeronautical engineers in the country. It was designed after a very careful study of conditions in the aircraft industry for the purpose of meeting the needs of commercial aviation. "We found," said Mr. Douglas, "that a ship to solve the problems confronting the commercial companies must carry a good load at a fair speed, have a reasonable landing speed, and above all be simplified and standard in construction and cheap in both initial and upkeep expense."

As a result of the investigation the "Cloudster" model was evolved, being a combination ship which can be built at a minimum cost consistent with first-class material and workmanship, and which can be adapted to a wide variety of uses without extensive changes in design. The plane, as being constructed now, will carry a pilot and five hours of fuel at full speed and a load up to 3000 pounds additional. This load may be divided according to the wish of the purchaser, the compartment of the plane being finished to order.

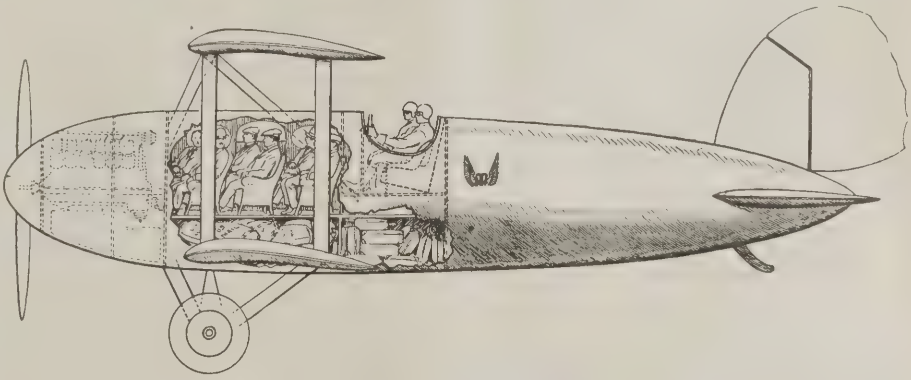
The ship can be finished as a combination passenger and express plane with a cabin holding six passengers for long trips, or nine for short trips and room for one other outside, occupying a seat in the pilot's cockpit. A large compartment beneath the passenger cabin holds mail or express or baggage. The passenger compartment is provided with every convenience including duplicate instruments showing air speed and altitude, etc. A unique system of dual control is provided in the pilot's cockpit so that in case of long trips a relief pilot can be taken along. In accordance with the best practice in this country and in Europe, the pilot sits outside for better visibility, and passengers are enclosed.

A full set of instruments occupies the dash including inclinometers, air speed indicators, compass, turn indicator, altimeter, gauges, etc. Self-starter is regulation equipment and every convenience for pilot as well as passengers is provided, the plane being designed for the purpose of relieving the pilots of much of the strain of correcting for "bumps," etc. The variable load is carried on the center of gravity so that the plane will balance as well empty as with full load. In addition an adjustable stabilizer of unique ease of operation and wide angle is provided. All controls are enclosed but every vital part is instantly accessible.

The plane is expected by its manufacturers to make a high speed of 105 miles an hour and a cruising speed of 85 miles an hour with landing speed of 45 miles an hour with full load. A ceiling of 18,000 feet with full load is anticipated.

The model now being constructed has a large roomy compartment but is not fitted up with windows and seats as it is to be demonstrated to the U. S. Army, Navy and Postoffice Departments first of all as a load carrier. After a number of trips carrying full load are completed, the plane may be converted for passenger service but the purpose of the builders is first to demonstrate its all around ability as a freighter.

Mr. Douglas, designer of the plane, built two different types of planes in Los Angeles in 1915 and 1916 which were the only planes ever designed and built in Southern California that ever held world's records.

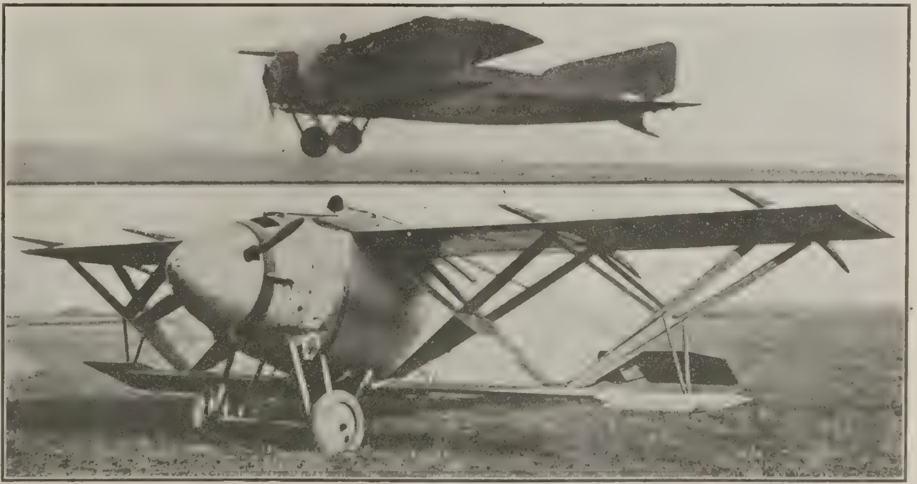


The Davis-Douglas "Cloudster"

ANOTHER NEW WING

Simultaneously with the announcement of details of the Handley Page wing another device has been developed by Levasseur, the inventor of the Antoinette monoplane, Robert Gastambide, and Mr. Latham, a cousin of Hubert Latham, and consists of reducing the speed of the alighting aeroplane by varying the superficial aera of the upper wing. Two sliding extensions of the wing are fitted, one in front and the other behind, so that when the pilot desires to reduce speed for landing they can be made to move outward in such a manner that the wing surface is increased from, say, thirty square metres to fifty.

The speed, it is claimed, is reduced by this device from, say, 125 miles an hour to 38. Curiously enough, this is practically the same reduction as claimed for the new Handley Page device. Trials of the new variable surface wings have been made at Etampes aerodrome by the French pilot Grandjean and are reported to have been regarded by experts present as in every way satisfactory. The machine is to make an effort very shortly to win the standing prize of 100,000 francs offered here for the best device to secure safety in flying.



The Gastambide-Levaseur special wing construction

REPORT ON GERMAN WIND TUNNELS AND APPARATUS

By EDWARD P. WARNER

(Concluded from last week)

The balance at the Junkers laboratory is of interest chiefly because it is completely autographic. The measurements depend entirely on springs, no weights being used. The balance carriage slides longitudinally and is carried on two steel rods running parallel to the wind direction. The weight of the carriage is considerable and the friction in sliding on fixed rods would be intolerably large, but this friction is practically eliminated by rotating the rods at high speed through a belt drive,—a very ingenius and successful method. The longitudinal motion of the carriage is proportional to the drag, and is transmitted through a linkage to a pencil which moves vertically over a record-sheet. The lift is measured by the tilt of a beam which carries the model and which is also restrained by springs, and is also transmitted through a linkage to a pencil making its record on the same sheet as the first one. The angle of attack is changed steadily and progressively by a motor which winds up a wire attached to the trailing edge of the model, and which, at the same time, rotates the drum carrying the record-sheet at a constant speed. The making of a complete test requires only about twenty minutes. No attempt is made to keep the speed constant automatically, the rheostats being set at a beginning of a run and then left alone. It is assumed that the changes in speed due to voltage changes are negligible.

The wing models tested are made of wood, and painted so that I could not examine the method of construction in detail. A very large number of thick wings have been tested, at least a hundred models being stored in their cabinets at the time of my visit, and work is still continuing in the effort to improve the present Junkers wing. The best results obtained to date with thick wings at Dessau are: Max. L/D 17.0, max. L_c .65, at 35 meters per second. The maximum lift coefficient is not in any way remarkable, and the high maximum L/D is largely accounted for by the way in which the model was supported. All tests are made with the aerofoil carried by a stream-line spindle about 3/16″ wide passing into the model at the center of the span and near the leading edge, and it is well known that such a support, when its resistance is corrected for in the usual approximate fashion, leads to values of the drag which are far below the correct figures.

The Zeppelin Wind Tunnel at Friedrichshafen

The only remaining wind tunnel of any importance is that which is under construction, but not yet completed, for the Zeppelin Airship Company. To be sure, there is a tunnel at Adlershof, but this is old and little used, and was fully described in the report submitted by Dr. Zahm after his tour in 1913 and published by the Smithsonian Institution.

The Zeppelin tunnel has been designed by, and is being built under the supervision of Dr. Max Munk, and is naturally similar in many respects to the Göttingen installation, since it was at Göttingen that Dr. Munk received all his aerodynamical training and much of the apparatus there was designed by him. The Zeppelin tunnel, however, is considerably larger than either of those at Göttingen, and will be the largest tunnel in the world from the time of its opening until the new 7′ x 14′ channel at the N. P. L. goes into action. The diameter of the wind-stream at Friedrichshafen is 3 meters. The drive will be by two Maybach engines coupled together in tandem, delivering a total of 500 H.P., and a speed of 30 meters per sec. is anticipated.

The most original feature of the tunnel design lies in the provision of air-tight gangways, of much larger section than the tunnel itself or even than the large end of the exit cone, for the return of the air. The principle is the same as a Göttingen, but the mechanicl execution is somewhat different, largely because of the great size of the laboratory. There are two return passages, one on each side of the tunnel, instead of a single one, and these passages take the form of gangways each about three meters wide and six meters high, with air-tight windows and air-locks and without any guide vanes at the corners. The passages are shaped at the ends so that there will be as gradual a change of section and of direction as possible, the whole, including the entrance cone, being made in concrete. The exit cone, however, is of wood. Since the gangways are air-tight, the throat section can be open to the atmosphere, just as at Göttingen, and admission to the test room is perfectly free at all times, no air-lock or other control being necessary. In order to permit access to the test chamber there is a subway under each of the gangways.

The slope of the exit cone is small, the vertex angle being 7½°, and the length is not sufficient to give as large an area ratio as is the usual custom. The length of the cone is to be 15 meters and the diameter of the propeller 5 meters, the propeller being driven with the same gear reduction as is employed in the Maybach engines on Zeppelin airships.

No honeycomb has been fitted as yet, and Dr. Munk hopes to avoid the use of any straighening device, but his hopes apparently have no sound basis.

The measuring instruments will be of the same general type as those at Göttingen, but naturally much stronger. The whole weighing apparatus is to be installed on an overhead platform where the observers will work, the support being by steel rails carried by concrete piers. The most striking feature about the balance is its construction, which follows Zeppelin airship lines faithfully, the cross-beams used for weighing the lift being built-up duralumin lattice girders. The total weight of the moving parts will certainly be less than in any other balance ever built for so large a VL. Of the two bridges, the forward one will be fixed rigidly to the rails, but the other will be mounted on wheels and will be allowed to move longitudinally as the angle of attack is changed so that the horizontal distance between the two bridges will always remain equal to the horizontal distance between the lower ends of the two sets of wires. The adjustment of the angle of attack is by raising one of the bridges, the supports for which slide on vertical rods. The bridge is raised with a cable which is wound up on a drum by turning a graduated handwheel.

The speed is to be controlled automatically by the same method as that employed at Göttingen, the servo motor operating the engine throttles instead of a rheostat.

The Friedrichshafen laboratory will work for the parent airship company and for all its subsidiaries, of which there are a considerable number, including the airplane firm at Seemoos (formerly located at Lindau) where the Dornier flying boats are built, and the aircraft company at Staaken, for which Rohrbach is the chief engineer.

HORIZONTAL BUOYANCY IN WIND TUNNELS

By A. F. ZAHM

Bureau of Construction and Repair, U. S. N.

THE following report on "Horizontal Buoyancy in Wind Tunnels" was submitted to the National Advisory Committee for Aeronautics by Dr. A. F. Zahm, Member, Committee on Aerodynamics.

Distinction of Relative Flow. From the earliest study of hydromechanics it has been assumed that the reaction between a stagnant fluid and a body moving through it is the same as for the fluid passing the fixed body with the same relative motion. So many experiments, however, seemed to disprove the assumption that at one time some prominent investigators questioned its validity. For example, Dubuat and Duchemin found experimentally that a plate fixed in a stream of water has about 30 per cent more resistance than when moving through still water at the same speed. This phenomenon was called "Dubuat's paradox." But when due precaution is taken to make the relative motion the same in both cases, as was done with an apparatus developed by Joukovski and Kouznetzoff, the assumption is completely vindicated. The reader may find a description of this apparatus in Joukovski's Aerodynamique, Chapter II.

But such equivalence of relative motion can not always be realized. When, for example, a body moves through an extended homogeneous still fluid the relative velocity of all distant parts of the fluid is uniform, and the undisturbed horizontal pressure gradient is zero; but when the fluid moves past the body usually all the distant parts have not the same velocity;

usually there is some turbulence and the pressure gradient is not zero. And if the gradient is not zero there is a horizontal buoyancy to be applied as a correction to make the observed resistance equal that for the still fluid.

Static Pressure Gradient. In untapering wind tunnels, for instance, there is a material fall of static pressure down stream within the walled working portion. If the tunnel is well designed and unobstructed, the down-stream pressure gradient is constant for any one wind speed, and varies nearly as the square of the wind velocity. If the tunnel is partly obstructed with apparatus, the gradient may, at any fixed speed, vary in amount from point to point along stream.

Point Pressure and Pressure Drag. In general, the pressural drag on a wind tunnel model, apart from the frictional drag, equals the surface integral of the horizontal component p_x of the point pressure p. Now this latter may be written $p = p_1 + p_2 + p_3$, where p_1 is the constant barometric pressure at the reference section A of the tunnel, say where the nose of the model is to be, and before insertion of the model; p_2 is the pressure drop down stream from A due to the static gradient in the unobstructed tunnel; p_3 is the kinetic pressure, or departure from p_1, due to the presence of the model in the stream. It is assumed that the tunnel is too large for material wall effect.

Obviously the drag due to the constant barometric pressure p_1 is zero. The drag due to p_3 would be zero for a frictionless fluid, but for natural fluids is a chief element of resistance, especially for bodies of blunt form. Its discussion is irrelevant to the present treatment. The drag due to p_2 may here be formulated for various conditions.

Computation of Horizontal Buoyancy. The component of horizontal buoyancy at any element of the model's surface is lp_2dS, in which l is the direction cosine, referred to in the tunnel axis, of the normal to the surface element dS. To find the surface integral of this component analytically one must know the equation to S; also to the pressure drop p_2, in terms of the distance along stream. The method of integrating is too familiar to require treatment here.

In wind-tunnel practice S and p_2 are usually given graphically, and may require graphical integration to find the drag due to pressure drop. For example, S may be a surface of revolution, such as a balloon hull; or a cylinder, such as a uniform streamline strut. The static pressure gradient may be given by a curved diagram, in which p_2 is plotted against the down-stream distance from the model's nose; or, as a particularly interesting case, the gradient may be constant. These special examples will be briefly treated in turn.

The pressure-drop drag on a surface of revolution with its axis along stream is

$$R = \int p_2 . 2\pi r dr = \pi \int p_2 . d(r^2), \qquad (1)$$

where p_2 is the pressure drop at radius r, and the integral extends over the whole surface. The integral is found graphically as the area of the curve obtained by plotting p_2 against r^2, both of which are assumed to be given for various distances along stream. This method was given in Report No. 107 of the British Advisory Committee for Aeronautics.

The pressure-drop drag on a cylinder held transverse to the stream, and having a plane of symmetry parallel thereto, is, per unit length,

$$R = 2\int p_2 . dr, \qquad (2)$$

where r is the semi-thickness at any point along stream, and the integral extends from front to rear. The solution is found graphically as the area of the curve of p_2 plotted against r.

If the pressure gradient is a constant, $dp_2/dx = a$, the pressure-drop drag on a body of whatever shape is

$$R = av, \qquad (3)$$

where v is the volume of the body. This formula is the same as that for the vertical buoyancy of a body immersed in a liquid, and has been known from time immemorial.

Methods of Computation in Practical Use. Formula (3) has been used in the reports from the Aerodynamical Laboratory, Washington Navy Yard, since July, 1919, when it was first shown by accurate measurement that the pressure gradient is constant along the working portion of the 8′ x 8′ tunnel freed of obstructions. In some of the earlier reports graphical integration had been employed because measurements, too hurried and insufficiently checked, had indicated a slightly variable pressure gradient. This mistake in measuring the gradient entailed an error of the order of one or two per cent in finding the total drag on the models tested.

A detailed account of the calibration of the 8′ x 8′ tunnel, for pressure gradient, is given in the laboratory's Report No. 148.

For streamline bodies of considerable bulk the pressure-drop correction is a good percentage of the whole resistance. If, therefore, the tunnel must have a material pressure gradient, it is fortunate when this is so nearly constant that formula (3) can be used to compute the pressure-drop correction. The value of a need be determined but once for a given tunnel, and the value of v for a model of any shape can easily be found by immersion in water.—*Technical note of the National Advisory Committee for Aeronautics.*

THE ODDY VARIABLE PITCH AND REVERSING PROPELLER

By A. M. BUCKWALD, M. E.

A VARIABLE pitch propeller assures the constancy of the motive power at the different altitudes, and improves the different times of climbs at all altitudes.

The ordinary fixed propeller is designed on the basis of the forward speed of the aeroplane, and until the aeroplane has reached the speed for which it was designed, the propeller is working inefficiently. To have efficiency, one must have a propeller that can take the place of the automobile gear-box, so that the tractive force can be altered at will, while the engine revolves at constant speed, internal combustion engines being only efficient at high piston speeds; but there are other reasons peculiar to aircraft.

Consider the subject of starting. An aeroplane standing at rest is not at all fulfilling the conditions under which the fixed bladed propeller was designed. High engine power is needed to make the propeller pull the aeroplane along, and large aerodromes are necessary in order that heavy machines may get up. Another point is that of excess power. When a machine is at top speed and is flying at the speed for which the propeller was designed, the thrust upon the blades is only that required to maintain that speed, and not to provide acceleration. The major portion of the engine power is thus required for the low speeds of the machine. To meet this, the automobile designer provides a gear-box, but with a fixed blade propeller, one has no means at his disposal for aeroplane work. Here is where the variable pitch propeller comes in.

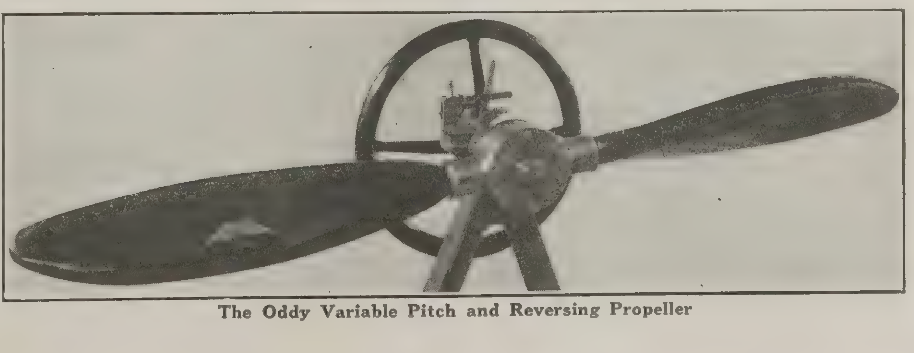
The Oddy Variable Pitch Propeller was exhibited at the London Aero Show. The description of manipulation is as follows:

First, the zero position, at which the blades are set when the machine is at cruiser speed, is the normal position, and the blades can only be moved from it by a deliberate act on the part of the pilot. Any movement from this position is clearly shown on the indicator plates, so that the pilot knows where his blades are set, at any moment.

Next, the blades can only be moved through a certain fixed angle at each movement of the levers, which amount is predetermined for each engine or machine. after this movement, the clutch automatically returns to the neutral position, ready for the next increment. If this amount is fixed at one-half a degree, the pilot must make his change of pitch by steps of one-half a degree. This is provided for both safety and efficiency. If the pilot wants to steepen his pitch two degrees, he moves his lever through one notch, then puts it back, which gives him one-half a degree; he then moves it another notch, then puts it back, which gives him another one-half degree—and so on.

This can only be done while the engine is running; this provision is made to guard against chance meddling. Also, a danger signal is provided to guard against the inadvertent alteration beyond a safe pitch.

The reverse running is intended mainly for manoeuvring of flying boats, which are rather difficult to handle in the water.



The Oddy Variable Pitch and Reversing Propeller

The Entries for the Pulitzer Trophy Race

Given reasonably good weather, the Pulitzer Trophy Race at Mitchell Field, Long Island, promises to be a great event. Forty-four machines have been entered, of American, French, British, Italian and German. The following is the list of competitors:

FLIGHT 1

No.	AEROPLANE	MOTOR	PILOT	ENTRANT
41	Thomas Morse (Am.)	Wright 300 H.P. (Am.)	Capt. H. E. Hartney	U. S. Army
42	Fokker (Ger.)	Packard 300 H.P. (Am.)	Major C. H. Wash	U. S. Army
43	Thomas Morse (Am.)	Wright 300 H.P. (Am.)	2nd Lt. Leigh Wade	U. S. Army
44	Ordnance (Am.)	Wright 300 H.P. (Am.)	2nd Lt. O. G. Kelly	U. S. Army
45	Ordnance (Am.)	Wright 300 H.P. (Am.)	Lt. St. Clair Street	U. S. Army
46	Loening Special (Am.)	Wright 300 H.P. (Am.)	Lt. B. G. Bradley, U.S.M.C.	U. S. Navy
47	Sopwith Dolphin (Br.)	Wright 300 H.P. (Am.)	Lt. C. E. Haynes	U. S. Army

FLIGHT 2

1	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. Carl Eliason	U. S. Army
2	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. J. B. Wright	U. S. Army
3	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Lt. (jg) V. C. Finch	U. S. Navy
4	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. Ray W. Brown	U. S. Army
5	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Lt. Walter R. Lawson	U. S. Army
6	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Capt. H. B. Mims, U.S.M.C.	U. S. Navy
7	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Major Davenport Johnson	U. S. Army
8	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Capt. Norbert Carolin	U. S. Army
9	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. Merrill D. Mann	U. S. Army

FLIGHT 3

11	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. Lucas F. Beau	U. S. Army
12	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. Lawrence Claude	U. S. Army
14	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Lt. John P. Roullot	U. S. Army
15	De Haviland (Am.)	Liberty 400 H.P. (Am.)	2nd Lt. R. C. Moffat	U. S. Army
16	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Lt. F. O. Rogers, U.S.M.C.	U. S. Navy
17	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Capt. Horace N. Heisen	U. S. Army
18	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Lt. (jg) D. L. Conly	U. S. Navy
19	De Haviland (Am.)	Liberty 400 H.P. (Am.)	Lt. Charles M. Cummings	U. S. Army

FLIGHT 4

21	Vought V. E. 7 (Am.)	Wright 180 H. P. (Am.)	Lt. (jg) W. B. Gwyn	U. S. Navy
22	Vought V. E. 7 (Am.)	Wright 180 H. P. (Am.)	Lt. (jg) A. Laverents	U. S. Navy
23	Vought V. E. 7 (Am.)	Wright 180 H. P. (Am.)	2nd Lt. L. H. Sanderson, U.S.M.C.	U. S. Navy
24	Vought V. E. 7 (Am.)	Wright 180 H. P. (Am.)	2nd Lt. W. V. Brown, U.S.M.C.	U. S. Navy
25	Vought V. E. 7 (Am.)	Wright 180 H. P. (Am.)	Gy. Sgt. J. K. Dunn, U.S.M.C.	U. S. Navy
26	Vought V. E. 7 (Am.)	Wright 180 H. P. (Am.)	Ensign W. J. Daly	U. S. Navy

FLIGHT 5

31	Sopwith S. E. 5 (Br.)	Wright 180 H. P. (Am.)	Lt. Lotha A. Smith	U. S. Army
32	Sopwith S. E. 5 (Br.)	Wright 180 H. P. (Am.)	2nd Lt. S. M. Aimes	U. S. Army
33	Sopwith S. E. 5 (Br.)	Wright 180 H. P. (Am.)	Capt. Felix Steinle	U. S. Army
34	Sopwith S. E. 5 (Br.)	Wright 180 H. P. (Am.)	2nd Lt. F. A. Johnson	U. S. Army

FLIGHT 6

51	Loening (Am.)	Wright 300 H.P. (Am.)	Lt. (jg) P. E. Gillespie	U. S. Navy
52	Ansaldo S. V. A. (It.)	SPA 200 H.P. (It.)	Arthur W. Fox	Eagle Flying Corp.
53	Spad (Fr.)	Hispano 220 H.P. (Fr.)	Capt. Maxwell Kirby	U. S. Army
54	Ansaldo S. V. A. (It.)	SPA 200 (It.) (Am.)	Willis P. Taylor	Aero Import Co.
55	Loening (Am.)	Wright 300 H.P. (Am.)	Lt. (jg) J. F. Wolfer	U. S. Navy
56	Ansaldo S. V. A. (It.)	SPA 225 H.P. (It.)	Albert Acosta	Aero Import Co.
57	Morane Saulnier (Fr.)	Le Rhone 110 H.P. (Fr.)	Charles Colt	Morane Saulnier

FLIGHT 7

61—	Curtiss Kirk Triplane (Am.)	Curtiss Kirkham 450 (Am.)	Lt. Cdr. W. B. Haviland	U. S. Navy
62	Curtiss Kirk Triplane (Am.)	Curtiss Kirkham 450 (Am.)	2d Lt. W.D. Culbertson, U.S.M.C.	U. S. Navy
63	Verville (Am.)	Packard 600 H.P. (Am.)	Lieut. C. C. Mosley	U. S. Army

The contestants will be started in seven groups, or flights, in the order given above.

In addition to the Pulitzer Trophy, Flight No. 1 is Competing for Contest Committee Invitation Prize.

Flights Nos. 2 and 3 are competing for the De Haviland Class Prize; Flight No. 4 for the Vought Class Prize; and Flight No. 5 for the Sopwith Class Prize.

(Am.) American manufacture; (Br.) British; (Fr.) French; (It.) Italian; (Ger.) German.

The Wright motors are the Hispano type.

ACCESSORIES

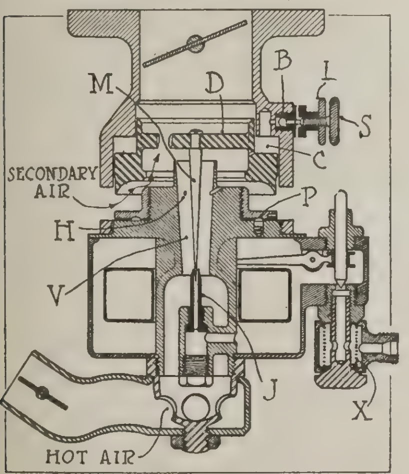
H. & N. Carburetor

A feature of this carburetor, which is of the central draft type, is a dashpot balanced annular floating air valve *D,* and integral fuel metering pin *M,* which measures with precision the quantity of gasoline and air required for maximum motor efficiency under all conditions of speed and load. All incoming air travels in a single column, the aim being to produce a perfectly homogeneous mixture, eliminating stratification and loading.

The working vacuum in the chamber *C,* which equalizes the vacuum above and below the dashpot, can be regulated by moving the ball *B* in and out by turning the adjustment screw *S.* Moving the ball in reduces the vacuum in the chamber, allowing the air valve *D* to move up and down more easily and weakening the mixture. Reversing the adjustment, of course, produces the opposite effect. When the correct adjustment has been determined it is fixed by tightening the lock nut *L.*

The gasoline jet adjustment is made by turning the threaded ring which forms the base upon which the dashpot rests, raising or lowering the dashpot and with it the metering pin *M,* which varies the jet opening. The ring may be easily turned through a slot. A spring plunger *P* holds the ring in position.

Starting with a cold motor and the present low grade of fuel is facilitated by the extremely high air velocity through the venturi *V,* which has been designed to be scientifically correct. Acceleration is very rapid because of the momentary retarding effect of the variable dashpot on the secondary air intake.

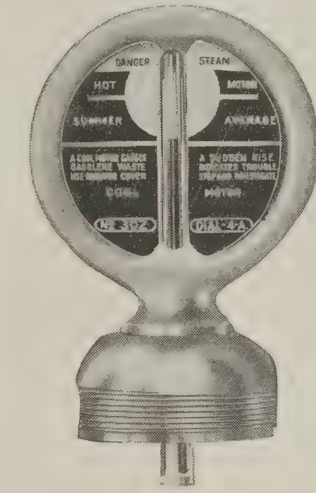


The gasoline enters the float chamber after being strained through the screen *X* and passes through the jet *J* to the venturi where it is mixed with the hot air taken in at the bottom of the carburetor. After leaving the venturi it passes through the mixing chamber, where it is thoroughly mingled with the auxiliary air and passes on to the combustion chamber of the motor. Holes *H* prevent condensation on the walls of the venturi.

Note.—H. &. N Carburetors are manufactured by the N. &. N. Carburetor Co., Inc., New York City. The manufacturers claim that the carburetor produces 1 hp. for every 58/10 cu. in. piston displacement in a four-cylinder 4⅛ by 5½ stock motor at 1700 r.p.m.

Boyce Moto-Meter

This appliance, manufactured by the Moto-Meter Company of 15 Wilbur Ave., Long Island City, N. Y., was originally designed for use on automobiles and is rapidly gaining favor with pilots of aeroplanes. Previous to the appearance of the Moto-Meter, the driver of an automobile or aeroplane had no exact method of determining the running condition of his motor while the car or aeroplane was in motion. The motor may have been over-heated or too cold, but the driver was apt to remain in ignorance of the fact until actual trouble developed.

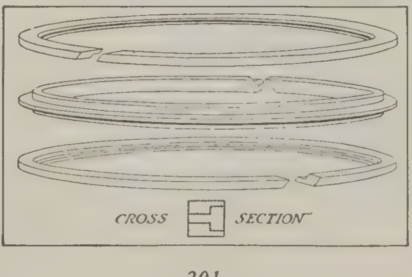


The Moto-Meter is screwed to the radiator cap and by means of a thermometer running through a circular dial, various conditions of the engine may be seen at a glance. The device shows the exact heat of the engine, telling when the motor is being operated at too high a temperature,—the cause of 80% of engine trouble. This certainty of actual condition precludes the possibility of running the motor further when over-heated. The Moto-Meter indicates lack of oil, need of water, and troubles arising from these conditions.

The Moto-Meter is standard equipment on the Glenn Martin Machines. It is also an interesting fact that the United States Government in its latest specifications for training aeroplanes, specifies the installation of "A radiator water thermometer visible from the rear seat".

Trump Multiple Piston Rings

Perfected as it is today, the piston ring was not evolved over night nor was it a happy inspiration, but is the product of serious and concentrated thought of ingenious minds working along the one line —conservation or efficiency. To obtain the greatest amount of power from a given unit of fuel and to put that power to work and keep it at its maximum with a minimum of waste has been the aim.



The Trump Multiple Piston Ring, manufactured by the Trump Manufacturing Co., Crown Point, Indiana, is the result of the study of the failure of the various types of other rings on the market and to meet the demand for a ring that would have the necessary staying qualities of proofness against the loss of compression and formation of excess carbon. That the design is logical and practical and not an experiment is a matter attested by their successful use in every style of motor.

Trump Piston Rings are composed of three sections, each section having equal resiliency and expansion, which, when assembled, forms a whole that gives uniform pressure at all points on the inner wall of the cylinder.

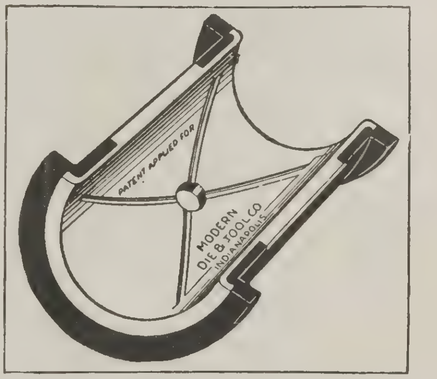
As will be noted on the sectional view of the above illustration the three openings of the sections are equally spaced on the assembled ring, forming an impregnable barrier to the escape of gas and compression.

Trump Rings are made of a close-grained iron of special formula and selected for its peculiar adaption to ring construction. The castings before being turned are allowed three weeks seasoning to adjust themselves to the conditions peculiar to cast iron

Each Trump Ring is ground to less than the one-thousandth part of an inch, thus insuring extreme accuracy in fit to your cylinder.

Victor Bearings

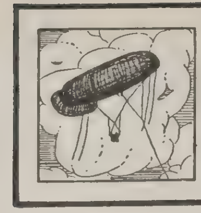
The heart of the aeroplane is its motor, and as a usual thing the first part of it to go seriously wrong is the bearings. In most cases this is because the bearing metal becomes loosened from its shell.



From experience in aeroplane motors, it has been demonstrated that "Victor" Bearings do not break away. The bearings are made bronze-backed, the bronze being a composition containing 85% copper. The babbitt metal used is whatever high grade tin base composition is specified by the customer.

The babbitt metal is securely sweated to the shell and also securely locked at the ends by means of a counter bore, and at the sides by a dove tail joint. This locking of the babbitt to the shell makes impossible an entire separation of the two metals. If, due to any abnormal strains, the tinning should come loose, the locking device will hold the bearing secure.

The Modern Die & Tool Co., Indianapolis, Ind., makers of Victor bronze back and die cast motor bearings, will be glad to receive inquiries in this line, and open



FOREIGN TECHNICAL DIGEST

Original Researches on the Use of Metal in Aircraft Construction

The article is an abstract of a lecture delivered by Dr. Junkers in December of last year.

The lecturer expresses the view that for big units duralumin wing girders present considerable advantatge over wood spars. The material, being homogeneous, lends itself to well-defined mechanical tests, and series construction becomes possible without being vitiated by the possible presence of faults and flaws in the material. In the construction adopted by Junkers in his monoplane, the wing girder traverses the body of the machine. This necessarily leads to a high centre of gravity, which, however, is stated not to be detrimental. The wing section adopted is of the high lift, large cross-section type. Due to the absence of struts and wires, the aerodynamic efficiency is very high. The wing covering thin duralumin sheet, which is welded together by special process. The machine possesses great mechanical strength and recently reached an altitude of 6,920 m. in 82 minutes, with a load of 8 passengers and a horsepower of only 182. (Dr. Ing. H. Junkers, *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Feb. 14, 1920, 4 cols., 3 diagrams, 4 photos.)

Forms of Hulls of Flying Boats

The object of this article is to derive general formulæ in connection with flying-boat hulls, and to deduce as far as possible the best forms of hull.

The power P required to drive the hull at a speed V is given as

$$P = KB^2V^3 \ldots\ldots\ldots\ldots(1)$$

where B^2 is the maximum cross-sectional area of the submerged portion and K is a coefficient depending on the form of the hull. If P is fixed, the velocity V can be increased by inclining the under surface of the hull so that a forward velocity produces a vertical component of the resistance and thus reduces B^2.

A formula is derived relating the draught at rest T_o with the weight per horsepower. If T_o is expressed in metres, and the power Q in kilogrammes per horsepower, the formula becomes

$$T_o = \frac{3}{Q} \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The breadth l of the maximum cross-section is given by the formula

$$l = (1.13P)\,\frac{1}{2.3} \ldots\ldots\ldots(3)$$

where l is expressed in metres and P is the total weight in metric tons. If the under surface is of the V type, l is the base of the isosceles triangle forming the V.

Transverse shape of the fore-body.—It is stated that for taking off from the water the best cross-sectional shape of the fore-body is that having a horizontal straight line for its lower edge. When alighting, however, a cross-section of this shape tends to cause the machine to make a series of bounds on the surface of the water, and a V-shaped lower edge is preferable. In the small flying boats the first cross-section is usually used, whilst for heavy types a combination of the two forms is employed, the arms of the central V being merged into two horizontal lines, one on each side. It is shown, however, that with this type there is a limiting velocity above which the hull cannot be driven through the water, so that the process of taking off becomes dangerous unless the flying speed is lower than this limiting velocity. A modification of this shape is recommended in which the two arms of the V are separated at their lower ends by a short horizontal line. The length of this horizontal line is calculated from formula (3) above.

Longitudinal shape of the under surface of the fore-body.—As the speed of the boat increases from zero to taking-off speed, the hull rises gradually further out of the water, and for the position at any instant the best angle between the water line and the tangent to the lower surface at the water line is that which makes the ratio Lift/Drag a maximum. It is recommended, therefore, that the under surface should be shaped so as to make an angle of 12° with the water line when at rest, and 3° when taking off, *i.e.,* at its lowest portion.

The following formula is derived for the length of the under surface of the fore-body:—

$$L = \frac{h}{2.6 \sin a} \ldots\ldots\ldots\ldots\ldots(4)$$

where L is the length in metres of the under surface measured horizontally from the point at which it enters the water when the hull is at rest to the taking-off point; h is the vertical distance in metres from the line of thrust to the water line at zero velocity; a is the angle of incidence of the main planes at zero velocity.

Longitudinal shape of the under surface of the after-body.—In alighting the contact with the water should be made in the neighborhood of the point vertically below the centre of gravity of the machine, and it is important that no reactions should be brought into play which might tend to alter the angle of incidence of the planes. The under surface of the after-body should be sloped so that it never comes into contact with the water, even when the machine alights at its lowest speed. It is common practice to slope this surface at an angle of 9° or 10° to the wing chord.

Transverse shape of the lower surface of the after-body.—The shape of the after-body has an important effect on the coefficient K in formula (1). The form recommended for the underside is a flat V whose arms make angles of about 6° with the horizontal.

The Step.—Methods of determining the position of the step or steps are given. (Maurice Blanchard, *L'Aerophile,* Apr. 1-15, 1920. 12 cols., 18 figs.)

Psychotechnical Testing of Sense of Balance of Airmen

The methods are described that were adopted in the military laboratory of Grossenhain.

The candidate is blindfolded and placed in a chair that can be tilted by electrical gear at will by the observer about two axes at right angles to each other. The candidate actuates levers by which he can counteract the motions that are imposed upon his chair, and the deviations from the normal position of the chair are recorded on scales. (G. Seiffert, *Praktische Psychologie,* Dec., 1919, 6 pp., 3 figs.)

Lift Theory for Aerofoils

In the second instalment, the author further develops the circulation lift theory by means of differential geometry.

Assuming two dimensional linear flow, a relationship is obtained between the variation of the centre of pressure and the parameters of certain surfaces of the Jonkonsky type. It is shown that a decrease in camber and an increase of thickness reduces the path of the centre of pressure. The author next extends the method, so that, given the parameters defining the resistance, a suitable wing shape can be predicted. In a further instalment the converse to this proposition is promised, *i.e.,* given a certain wing shape, determine its resistance parameters. The method presents considerable mathematical difficulties, and, considering the assumptions on which it rests, the agreement obtained with practice is considered satisfactory. (R. V. Mises, *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Mar. 15 and 31, 1920. 16 cols., 14 diagrams.)

Radial Engines

In the first part of the article it is shown that the radial engine offers no special lubrication difficulties, contrary to the general belief. In the second part the mechanical details of the engine are discussed.

The connecting rod assembly calls for the greatest care. The various methods employed are reviewed. The master rod with wrist pins is not favored for high rates of revolution on account of the large unbalanced forces. A forked connecting rod assembly on a floating bush is recommended. This method gives ample bearing surface and keeps the rotating masses as small as possible. A mathematical investigation is given for the out of balance forces of a 7-cylinder radial. These can be completely balanced by a single rotating mass attached to the crank. In order to keep the mass as small as possible, it is of the greatest importance to adopt very light piston and connecting rod construction.

According to the author, distribution should not present great difficulties. He obviously refers here to the water cooled type, like the Salmson, which construction he appears to favor. In the class of air cooled radials he refers to the A.B.C. and Cosmos engines, but doubts whether the published figures could be obtained on continuous load. The A.B.C. practice of copper plating the steel fins is mentioned, but the author is at a loss to see any advantage in the procedure. The correct way of increasing the cooling is to have high conductivity (aluminum alloy) heads screwed on to ordinary steel barrels. (Otto Schwager, *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* May 15, 1920, 4 cols.; May 30, 1920, 13 cols., 5 diagrams.)

NAVAL and MILITARY AERONAUTICS

Transatlantic Fliers Receive Navy Award

Pensacola.—The crew of the N C-4, first seaplane to make the transatlantic flight, now stationed at the naval air station here, were among the recipients Nov. 11 of naval honors.

Lieut.-Commander Albert G. Read, who commanded the ship, received a distinguished service medal, while Lieut. J. G. Rodd, his radio officer in the flight, and Chief Machinist's Mate E. G. Rhoads, who handled the motors, received navy crosses.

Capt. H. H. Christy, commandant of the station, who commanded vessels in European waters during the war, also was awarded the medal.

Naval Seaplane Believed Lost on Lake Michigan

Chicago.—A naval seaplane of the F-2-L type, with three men aboard, is believed to be lost somewhere on Lake Michigan. The plane left Great Lakes Naval Training Station Nov. 10 on a photographic reconnaissance tour of the west coast of the lake.

The seaplane was of Ensign Edward M. Clarke of Peoria. With him were Machinist Harry C. Barr of Lake Forest and Chief Printer Frank J. Caesar of Hollywood, Ill.

Army Fields Named for Two Aviators

Announcement was made at the War Department that the aviation field at Camp Stotsenburg, Pampanga, P. I., had been named Clark Field, in honor of Major Harold M. Clark, Air Service, U. S. A., who was killed in an accident in the Panama Canal Zone, May 21, 1919. The aviation field at Fort Mills, Corregidor Island, P. I., has been named Kindley Field, in honor of Captain Field Kindley, Air Service, U. S. A., who was killed in an accident at Kelly Field, San Antonio, Texas, Feb. 1, 1920. Both deaths were in line of duty.

Pensacola Station News

Twelve type SE-1414 aircraft radio receivers for installation on aircraft were received this week. These were badly needed, and are being used to replace the type CW-1298 receivers on H-16 and F-5-L flying boats.

During the past week a total of 58 birds were used by the various departments of the Air Station. A total distance of 1,100 miles was covered by these birds in delivering messages from free balloons and seaplanes.

A large perfectly marked red Carneaux pigeon was placed in the loft by a sailor who had been given the bird in town by people who believed that he belonged to the Air Station. These people had picked the pigeon up in a starving condition and fed him. He is now on the breeding side and will be kept for a brooder unless the owner can be located. His band number is 79, on a removable band.

Four hundred and nineteen flights were flown in heavier than air craft, for a total of four hundred and nine hours and fifteen minutes (409:15).

The following long distance flights were made 16th and 17th October, 1920:

F-5-L No. 4009, Lieutenant Rica Botta, USNRF, officer in charge, to New Orleans, La., via Biloxi, Miss.

N-9 No. 2615, Lieutenant (jg) Lambert Hewitt, USNRF, officer in charge, to Biloxi, Miss.

Squadron I (N-9's)—Flying time, 89:45; average number of planes available, 12.

Squadron II. (HS-2's)—Flying time, 127:00; average number of planes available, 7.

Squadron III. (H-16's. F-5-L's)—Flying time, 110:45; average number of planes available, 7.

Squadron IV. (R-6-L's, N-9's, HS-2's)—Flying time, 81:45; average number of planes available, 11.

Lighter Than Air Department

In General.—Operations were carried on three days this week. There was no flying on Wednesday on account of high winds.

Free Balloons.—Six free balloons made flights during the week, three for instruction and check flights and the other three were solos, making a total of 44 hours and 30 minutes.

Kite Balloons.—Kite Balloon A-2789 made five flights, for 9 hours, during the week.

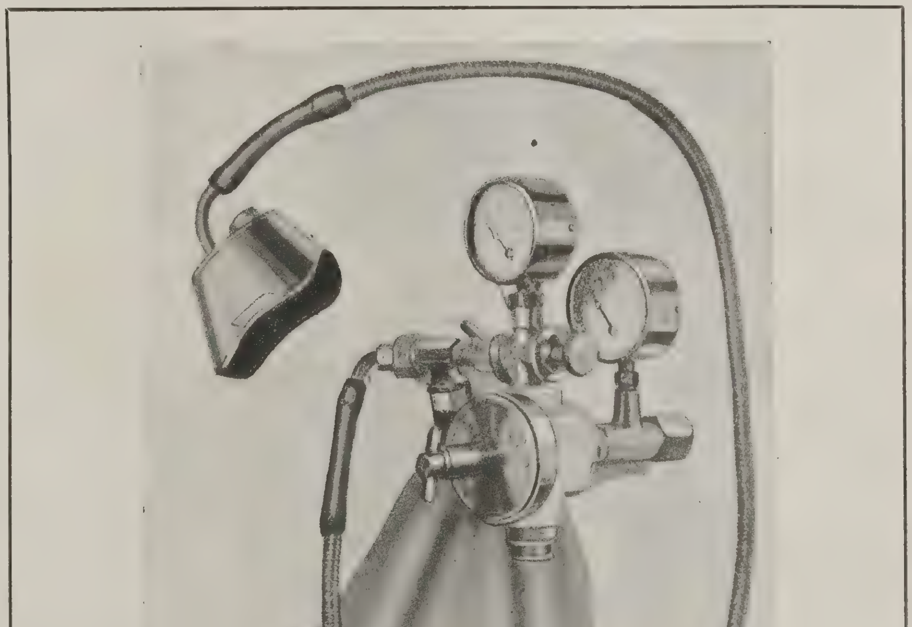
Dirigibles.—Thursday the C-7 was sent out on a test flight and was found to be 1½ degree nose heavy. It was then given another alignment and is now ready for flight. The C-7 made one flight for 15 minutes this week.

B-17.—On the first part of the week a great deal of trouble was experienced with the magnetos, which reduced the flying time considerably. On Thursday, the magnetos having been repaired, the ship made a flight of about ten minutes, having to return on account of motor trouble. the motor was then changed, and the ship is now ready for its trial flight with the new motor. The total for the week was six flights, for a total of four hours and 45 minutes.

Airship Will Aid in Recruiting Drive

The airship has proved to be one of the greatest of crowd-attracters, and the biggest commercial enterprizes of the country have began to utilize it as an advertising factor of front rank.

The navy airship B-18 will be used at Venice, Cal., to aid in the big drive being put on in that city for the purpose of enlisting native sons in the Navy for the great new super-dreadnaught, U. S. S. California. The North Island airship will flood the city with recruiting literature as well as perform for the benefit of the throngs of curious airship fans. The blimp will spend several hours soaring over the canal city.



German oxygen mask for altitude work

FOREIGN NEWS

The British Air Navigation Bill

In the House of Commons on October 22, Mr. Churchill moved the following resolution:

"That it is expedient to authorize the payment, out of monies provided by Parliament—

(*a*) of such sums as may be required for the contribution from the United Kingdom under any Act of the present Session to enable effect to be given to a convention for regulating air navigation, and to make further provision for the control and regulation of aviation; and

(*b*) of any expenses incurred by the Secretary of State or the Air Council in the exercise of their powers under any such Act."

He said it was a purely formal resolution to regularize the position of the Air Navigation Bill, which had received its second reading on August 9, and was committed to Standing Committee A. It was necessary to pass it to enable the Standing Committee to carry on its work.

In the brief debate Commander Kenworthy protested against the small amount of financial support given by the Government to commercial aviation. The resolution was agreed to.

Argentine Air Mail

A company has been organized in the Argentine Republic, with a capital of 1,000,000 pesos, Argentine currency, to establish a regular airplane-mail and parcel-post service between Punta Arenas and Buenos Aires.

Royalties on the Joy-Stick

M. Esmault-Peleterie, the inventor of the joy-stick, has won the case brought against a previous judgment by Farman Bros., and is now in a position to enforce the payment of royalties amounting to about 20,000,000 francs.

Air Ministry Staff

A statement showing the staffs of Government Departments on September 1, 1920, has been issued as a White Paper (Cmd. 981, 1d., H.M. Stationery Office). The total number employed at the Air Ministry is given as 2,529, of which 771 are on the permanent staff. The figures, which show a decrease of 61 as compared with August 1, do not include units and command offices, etc., the staff of which numbered 2,900 on April 1, 1920.

French Airship Flight

French Naval airship A. T. 19, which forms part of the Mediterranean air fleet, has flown from the military aerodrome at Saint Cyr to its station at Aubagne, Bouches du Rhône, a distance of 470 miles, in 11½ hours. The airship, with ten passengers on board, made the journey without a stop and landed safely.

Berlin to London in Six Hours

A commercial aeroplane, chartered from Messrs. Handley Page, Ltd., flew yesterday in two non-stop flights from Berlin to London—a distance of 670 miles—in six hours and 10 minutes. The machine. piloted by Lieutenant Vaughan Fowler, and carrying one passenger, flew by way of Hanover to Cologne (330 miles) in three hours and 10 minutes. Traveling south of Brussels and by Calais, the aeroplane completed the remaining 340 miles to the Cricklewood Aerodrome in three hours.

Dundee Makes a Move

The Dundee Corporation is fully alive to the importance of commercial air transport and is contemplating a scheme to link up Dundee with Edinburgh, Glasgow and Aberdeen. It already has under consideration a proposal to utilize ground at the Western Esplanade for aerodrome purposes, the site having been reported upon favorably by aviation experts.

Canadian Aeronautical Developments

The Canadian Air Board has now completed a "road" map of the sky for Canada, which will cover every route laid out within the Dominion. One of its most important features is that it is drawn to deal both with civil and military aviation. When it is revised and finally published Canada will have as complete a directory of air travel as it is possible to obtain. The map has involved an aerial survey practically of the entire Dominion. The Dominion is making use of the skill achieved by numbers of the Canadian pilots whose record in the R. A. F. is so brilliant; the pulp and paper industry is employing airmen on fire patrol duties in forests; aircraft are being used for coast fishery patrol purposes in British Columbia; and recently Mr. Irvin Proctor, of Toronto, President of the Canadian Aero Film Company, Limited, returned from an extended aerial journey through the northern part of the Province of Ontario. His trip was made at the request of the Provincial Government in order to obtain photographs of the various parts of the province for forestry and agricultural purposes. In the journey northward Mr. Proctor, accompanied by six men, passed over the Algonquin National Park and thence to Hudson Bay, bringing back glowing reports of the timber resources available *en route*.

An Armenian Air Service

From a brief report from *The Times* correspondent at Constantinople, it appears that the Armenians are fighting well, and their small but well-organized Air Force has rendered considerable service.

No Germans to Land at Frankfort

The air service which it had been proposed to start between Frankfort and Basle is not likely to get under way just yet as the French Government has put its foot down on any German aviators landing at the former place.

League of Nations and Aviation

After hearing M. Bourgeois' report on the work of the Permanent Advisory Committee on Military, Naval and Air questions, the Council of the League of Nations, at the concluding meeting of the Session at Brussels on October 28, admitted the necessity of watching, with special attention, for the possible transformation of commercial aviation into a system adapted for war. It was insisted that investigations in this matter must be made by experts.

Air Work in Mesopptamia

The *communiqué* issued by the British War Office on October 25 stated:

"On the 21st . . . . a hostile force in position S.E. of Musaiyib . . . . was bombed by aeroplanes and lost heavily."

The *communiqué* of October 27 stated:

"Lower Euphrates.—On the 23rd aeroplanes bombed and fired on other concentrations with good effect, and they appear to have dispersed, as on the 24th aerial reconnaissance reported nothing of note in that quarter.

"Middle Euphrates.—Our aeroplanes successfully attacked enemy bands west and southwest of Hillah on the 23rd. Our picket at the Kufa Aerodrome was sniped on the same date. The entrenched positions held by the insurgents on both banks of the river between Hillah and Jerboia were bombed by our aeroplanes."

The *communiqué* of November 1 stated:

"Our aeroplanes have been active against hostile gatherings in the area S.E. of Kufa."

The Seaplane-Carrier "Eagle"

On completion of her trials, the seaplane-carrier "Eagle" is to proceed to Devonport, where she will be berthed pending arrangements for her to be taken in hand at a Royal dockyard. On arrival at Devonport she will be paid off in charge of a care and maintenance party and placed under the orders of the Rear-Admiral, Reserve Fleet.

German Aerodromes to Be Retained

The Berlin correspondent of Handley Page, Ltd., reports that the Inter-Allied Aviation Commission, appointed under the Treaty of Peace, has consented to waive the destruction of the following military aerodromes: Breslau, Gandau, Brunswick, Fuerth, Grossenhain, Hamburg, Paderborn, Schleissheim, and Deveen, near Königsberg. The following seaplane stations are also included: Kiel-Holtenau, Norderney, Warnemuende, and Lift, as well as the airship harbours of Nordholz, Seddin and Friedrichshafen-Löwenthal. Fifteen per cent of the privately-owned aviation buildings which were used for military purposes during the War are also to be left standing. With very few exceptions, the airship halls are to be pulled down in accordance with the provisions of the Treaty of Peace.

The Wright Patents in France

The French aviation industry seems to have its fair share of troubles. Now that the "joy stick" litigation is settled, at any rate for the moment, the owners of the French Wright Patents have secured from the Courts a writ of attachment on some 3,000,000 francs, owing by the Minister of Finance to one of the French Constructors. The writ has since been modified as regards 300,000 francs of the total which the firm requires immediately for development purposes.

A Hitch Over the Riga Service

From Königsberg, according to *The Times* Berlin correspondent, comes a report that the German aeroplane D 43, while making a trial flight between that place and Riga, preparatory to being employed in civil aviation service by the Deutsche Luftreederei, has been detained at Königsberg by an officer of the Inter-Allied Control Commission, on the ground that it is really a war machine falsely described. The company is reported to have lodged a protest to the German Government.

Programme of Racing for 1921

At the meeting on October 27 a general discussion took place on the Royal Aero Club's programme of races for next year, drawn up by the Racing Committee. It was decided to meet again within a month, by which time the Committee of the Society of British Aircraft Constructors would have had an opportunity of considering the proposals put forward by the Club.

It was reported that a speed rate, to take the place of the Gordon Bennett Race, would no doubt be instituted next year, and the conditions to be recommended to the Federation Aeronautique Internationale were discussed.

The conditions for next year's Jacques Schneider Race were also discussed and deferred till next meeting.

The proposal of the Club's Racing Committee to hold the Aerial Derby in June, 1921 was reported.

The classification of machines was discussed and deferred pending a report from the Technical Committee of the Society of British Aircraft Constructors.

"Daily Express" £10,000 Prize

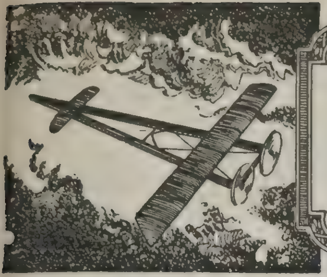
The Government having stopped all attempts to win this prize, owing to the conditions on the routes in the Near East, and the competition having closed on October 31, 1920, the Club approached the proprietors of the *Daily Express* with a view to the competition being reopened next year.

In a letter to the Club dated October 20, 1920, Mr. R. D. Blumenfeld replied that having gone fully into the question the proprietors of the *Daily Express* had reluctantly come to the conclusion not to do so.

A New Record

Lieut. Umberto Maddalena recently carried out a big flight. On board a Savoia seaplane, having one passenger with him, he accomplished the Sesto Calende (Italy)-Stockholm-Riga-Reval-Helsingfors-Aland Isles and the Swedish Coast flight, thus traveling over more than 4,300 kms.

This is the longest flight ever performed with a seaplane, and it constitutes an actual world record which the Royal Aero Club of Italy will refer to the Fédération Aeronautique Internationale.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

By John F. McMahon

A Scientific Flying Model

WHILE on the subject of flying models, we must not forget one very important type of model known as the Scientific Model or one in which a regular tested wing curve is used.

If you are building models and the only reason you are is the pleasure you get from flying and building these models, I would like to have you start on one like the one shown in the accompanying drawing, as this model is not only a good flyer, but will show many advantages you have never seen in any of your previous models.

Some years ago it was the custom among the model clubs and model flyers to have efficiency contests for flying models. The contest was decided by the models carrying the greatest load for a certain surface area, etc. In this way many little things were found that never dawned on us before, and the result was we built some of these ideas into our racing models, and made longer and better flights.

I would suggest selecting a certain fixed area, about 144 square inches (as I have in the model shown in the drawing) for the main plane, and about 40 inches in the elevator. This is a fair average for this type of model and the one from which we will get the best results.

Many little experiments can be carried on by the aeromodelist such as using raked edges, then wings without the rake arrow shaped wings (that is, with a sweep back) with or without a dihedral, or even a reverse dihedral, that is, have the wings sloping downward instead of upward. Different loads can be carried at different angles of incidence and the most efficient angle can then be found.

In fact almost every conceivable kind of an experiment must be taken into consideration and I claim that when you have finished with this model you will be able to build long distance flying models that will go hundreds of feet farther than your previous models.

New tricks in design are what make an aeroplane better and it is not necessary for one to be an expert engineer to invent or develop some little thing that will improve the aeroplane or make aviation safer and more interesting. The field is large and you, the model fliers, have the same chance as those who went before you and who are to-day making aviation history.

The building of the model shown herewith is really simpler than it looks; the only catch is to get the Balsa Wood that is needed for the wings and motor stick.

While the wings look as if there are too many ribs, this is not the case, as we are using a true wing curve and it is necessary to preserve the wing section along the whole length of the wing, otherwise the fabric would cave in between each rib and the wing section would be correct only at each rib.

The ribs of the wings are made of this Balsa Wood. (Balsa Wood is the lightest wood known, its weight being about one-tenth the weight of spruce.) And it can be purchased from almost any model supply house. If your particular supply dealer does not carry it you can purchase it from The American Balso Co., New York City.

To construct the ribs, select a block of the wood and shape it like the wing profile shown at the right hand lower side of the cut.

The wood should be so shaped as to have the grain running the length of the ribs when you finish.

After shaping the wood to the proper wing curve holes should be drilled for spars. Then ribs 1/16" thick should be cut from this block with a saw.

The ribs for the elevator are also made in this way and when all are finished they should be run on round spars made of dowel sticks and glued in place. Care should be taken not to split the ribs when putting them on. It would be good practice to make the hole in the ribs a trifle larger than the diameter of the spar. The spars in the large plane are ⅛" and in the elevator 3/32". The entering edge of both elevator and main plane is of 1/32" bamboo rounded with sand paper.

When the wings are finished cover them both sides with thin China Silk or Bamboo paper, and dope with Ambroid Varnish.

The motor stick is made of a piece of Balso Wood 3¾" x ¾" and shaped to the cross section in the centre of the drawing.

One propeller drives the model and this is twelve inches in diameter and is made from a block of clear grained white pine.

Aero Science Club Note

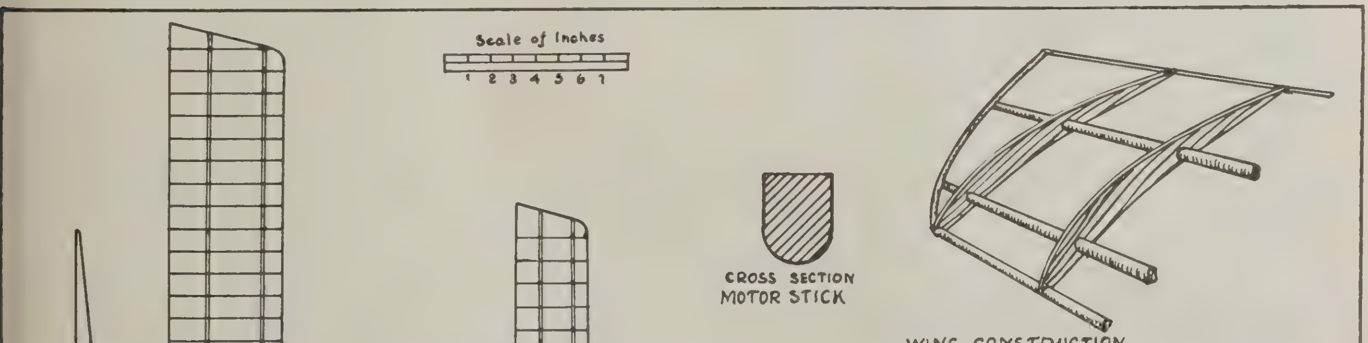
The Aero Science Club recently held its annual meeting and elected the following officers:

Mr. Edward Durant, President; Mr. Arthur N. Ott, Vice-President; Mr. Ladis Gladki, Secretary and Treasurer; Mr. Wm. J. Buch, Director of Model Const.; Mr. Stanley Y. Beach, Director of Pub. and Membership; Mr. Harold McMickle, Technical Advisor.

In order to increase the interest in the power driven model (the record for the compressed air driven model being about 423 feet) the club has decided to offer a suitable cup to the builder and flyer of the first mechanical driven model to surpass the record, in a contest to be held at Van Cortlandt Park, New York City, in the near future.

The club is rapidly recruiting new members and is one of the few "live" organizations as well as the oldest aeroplane club in America.

Applications for membership should be sent to the secretary at the Beach Building, No. 125 East 23rd Street, New York City. Anyone interested in models or model flying is eligible and there is also a Junior division for the younger model enthusiasts.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Answers to Technical Queries

Dear Editor—Will you kindly advise me of the method to follow to come down when my engine stops while at a great height.

Answer—No method needed; you will come down without any effort on your part.

Dear Editor—I have recently perfected a combination aeroplane and submarine. Could you tell me where I could find some one interested in such an apparatus?

Answer—Drop in at the nearest insane asylum; they have been waiting for you a long time.

Dear Editor—When I start the propeller on my aeroplane the machine goes the wrong way. What shall I do?

Answer—Turn your seat around and drive the machine backward.

Dear Editor—When my mechanician turns the propeller over, the engine does not work. What shall I do?

Answer—Try putting a little gasoline in the tank.

Dear Editor—Many times as I am ready to start for a flight I find that my engine is missing. What shall I do?

Answer—(Refer to the Lost and Found Department.)

Dear Editor—I find that I lack the courage to fly, yet I am very ambitious. What is the remedy for this?

Answer—Courage can be procured at twenty-five cents a flask at any good saloon. (Yes, thank you, we do.)

Dear Editor—I have just finished building a new aeroplane but do not know how to disassemble it.

Answer—Show it to someone who knows a *good* machine when he sees it. He will pull it apart.

Passenger—"Time must hang heavy on your hands."

Pilot—"Why, honey?"

Passenger (recklessly)—"Well, you wear a wrist watch."—*Jester.*

At the Aviators' Hotel

Fancy—"This breakfast food looks like saw dust."

Full—"Yes, it's fine board we get here."

Indignant Waiter—"Pardon, sir, but this coin you gave me is bad."

Departing Diner—"Did you ever stop to think about your service?"

Poor Stock for Investment

The stock of balloons is going up,
The makers are elated;
But don't you put a cent in them—
The darn things are inflated!

Rather Dense

"And when you fly over Pittsburgh you carry a broom to sweep the smoke away?" interrogated the admirer.

"Sure thing!" laughed the aviator.

"Do you carry a broom when you fly over London?"

"No; I carry an axe."

Proposed Regulations for Aeronauts

1. An operator, before abandoning car in case of wreck, shall hang out a red light and whistle three times.
2. Before dropping out bags of ballast, operator shall sterilize same, as protection for pedestrians below.
3. Always turn to the Wright, saluting.
4. Ships of a thousand bird power and over shall be painted canary yellow.
5. Drivers running past toll stations shall be subject to double fine.
6. If operator discovers hobo beating his way on the bumpers, he shall eject same at next regular station. It shall be unlawful to evict him in midair.
7. All passenger schedules shall be open to the inter-air commerce commission.
8. All airships must be equipped with airbrakes.

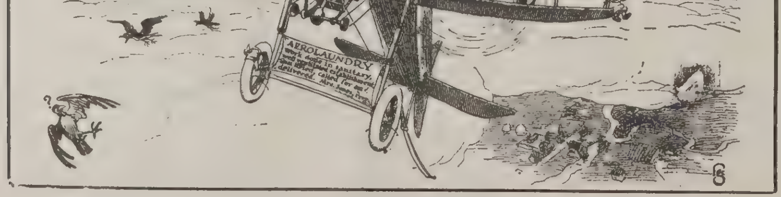
Literally

"Here are a lot of suggestions from outsiders as to how to run this newspaper. See that they are carried out."

"Yes, sir," said the office-boy, and, putting them all in a waste-paper basket, promptly carried them out.

Mechanic—"I'd like a nice pair of flannels for about three dollars."

Clerk—"I'm sorry, sir, but we haven't any nice ones at that price."



A Bum Steer

Pilot (with worried look): "I'm afraid the rudder is broken."

Fair Passenger (sympathetically): "Oh, never mind, it is behind us most of the time and no one will notice it."

Quick, Henry—the Self-starter

Gearshift—"We were out in the machine yesterday and got caught by the storm."

Magneto—"It must have been unpleasant."

Gearshift—"Oh, no; it was a driving rain."

9.105 Engineering
EA

AERIAL AGE
WEEKLY

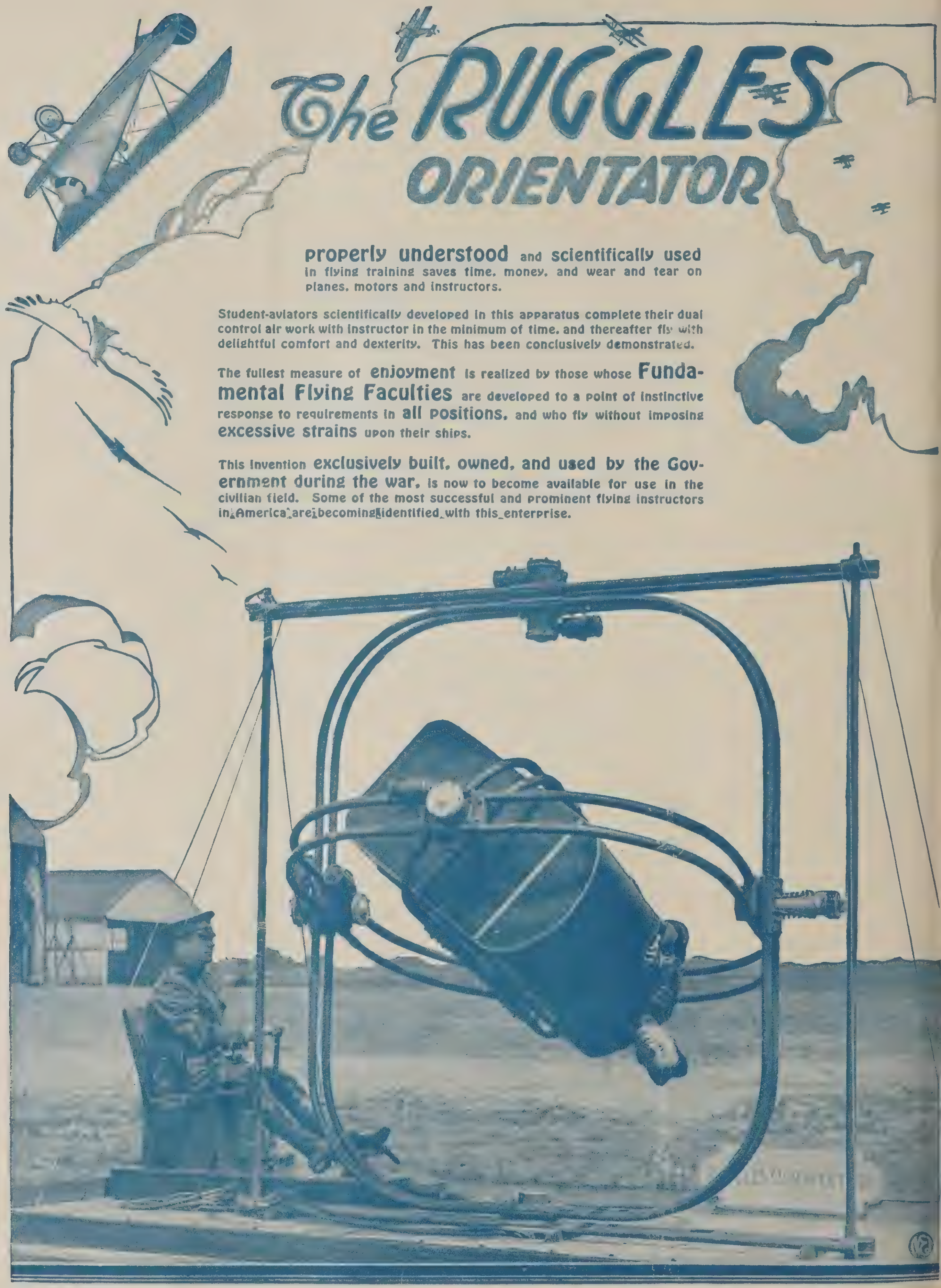
. 12, No. 12 NOVEMBER, 29, 1920 10 CENTS A COPY

Photo U. S. Army Air Service

Airscape of Sing Sing Prison

Aerial Mail as a Promoter of Commercial Aeronautics

SHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY



The RUGGLES ORIENTATOR

properly understood and **scientifically used** in flying training saves time, money, and wear and tear on planes, motors and instructors.

Student-aviators scientifically developed in this apparatus complete their dual control air work with instructor in the minimum of time, and thereafter fly with delightful comfort and dexterity. This has been conclusively demonstrated.

The fullest measure of **enjoyment** is realized by those whose **Fundamental Flying Faculties** are developed to a point of instinctive response to requirements in **all positions,** and who fly without imposing **excessive strains** upon their ships.

This invention **exclusively built, owned, and used by the Government during the war,** is now to become available for use in the civilian field. Some of the most successful and prominent flying instructors in America are becoming identified with this enterprise.

THE RUGGLES ORIENTATOR CORPORATION, 168 West 73d St., New York City

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AERIAL MAIL AS A PROMOTER OF COMMERCIAL AERONAUTICS

POSTMASTER BURLESON made a blunder when he issued his dictum cancelling the special stamps which had been issued for the aerial mail service. At one stroke he cut off the finest possible advertisement for commercial aeronautics. Thousands of people were beginning to think in terms of aerial transport for their mail, and even at that it would have been a long time ere half of our population had received the thrill accompanying the receipt of their first letter by air post.

Letters mailed today between New York and Washington may, by a mere accident, be carried by aeroplane, but the recipient is none the wiser. If it bore a special stamp, or even a special cancellation stamp, the subject of aeronautics would for at least a brief moment be in his mind, and eventually we would have a great many of our citizens thinking aeronautically.

This would be a vast advertisement for commercial aeronautics. If mails were transported regularly and efficiently through the air, and the letter-writing public were made to know it, some of the difficulties and hazard which they foresee concerning commercial air lines would disappear.

When the new Postmaster General is appointed next year this matter should be brought to his attention with compelling force, and the Manufacturers Aircraft Association might do a great service to the industry by following the example of the Motor Truck Association, which did good work in the "ship by truck" movement, by appointing a committee to interview business executives and persuade them of the value of "mail by air."

Only the other day a mail plane delivered its load from Cleveland to Mineola in a little over four hours, and yet probably not one per cent of the recipients of the letters in the consignment will realize that in his letter he has a historical document. Tremendous advertising value for aeronautics was lost in that journey.

The Safety of Flying

The city of San Francisco has done aeronautics a real service by compiling a résumé of flying accident statistics for the past year.

"During the twelve months ending on the 15th inst. more than a thousand newspaper clippings relating to meteorology and aeronautics were filed. As a matter of general interest, and valuable as confirming public confidence in aerial passenger traffic, we have prepared a compilation of all of the aeronautic fatalities reported by the Associated Press from last September to date.

"There were thirty-seven aviation accidents reported in the United States and its possessions during the past twelve months. 'Stunting' was responsible for 22 per cent of the accidents, engine trouble caused 16 per cent, adverse weather conditions 13 per cent, and other miscellaneous causes 19 per cent, leaving 30 per cent unknown. Of all of the states of the Union, California took the lead in aeronautic activity. It is safe to assert that California has more aeroplane flights to its credit than all of the other states combined.

"There were fourteen accidents in California, and of these six were military and eight were in commercial flying. These accidents occurred in thirteen aeroplanes and one seaplane.

"There were no fatal accidents reported in either balloons or dirigibles during the year in California or elsewhere. Of the six accidents in governmental flying, three were in the army, two in the navy, and one in the forest patrol.

"Of the fourteen fatal accidents in flying in California, five were caused by stunting and five by engine trouble. The cause of the accidents show the following distribution:

Stunting or exhibition flying	5
Engine trouble	5
Weather conditions	0
Other causes	1
Unknown	3
Total	14

"It will be observed that adverse weather conditions have not been responsible for a single fatality in aeronautics in California during the year ending this month. Records from other places in the United States and its possessions show that weather is the cause of nearly as many accidents in aeronautics as engine trouble.

"Reports from two of the large commercial aviation companies in the vicinity of Los Angeles show that these companies have carried in the aggregate more than 20,000 passengers on as many air trips during the year, and all of these journeys have been completed without an accident.

"Of the transportation necessities now confronting the country, one of the leading shipping authorities places them in the following order: First: Building of highways (automobiles and auto trucks). Second: Railway requirements (rehabilitating the railroads of the country). Third: Waterways' usefulness (utilizing ocean, lake, river and canal waterways). Fourth: Air possibilities (aeroplanes, seaplanes and dirigibles).

"The last-named is mentioned as a possibility and the transportation authority placed aeronautics in that class because of the newness of this mode of transportation. That aerial navigation is considered as one of the four of the great transportation problems is more of a tribute than could have been paid to automotive transportation a scant dozen years ago. Although the first trip between Los Angeles and San Diego was made only a few years ago, such a trip now excites no more interest than a similar journey by automobile ten years ago."

THE NEWS OF THE WEEK

Plan Dash by Aeroplane to New Arctic Oil Field

Edmonton, Alb., Nov. 18.—This country is preparing for the first rush by aeroplane to the petroleum fields near Fort Norman, on the Mackenzie River, nine hundred miles toward the frozen North, heralded by Dominion surveyors as richer than the oil lands of California.

Negotiations already are under way for establishment of an aerial service out of Edmonton, with landing stages along the route provisioned with food and fuel for prospectors and aeroplanes.

The World Boards of Aeronautical Commissioners

This board is now composed of sixty-three members, leading men of the countries and colonies in the sections of the world they represent. When the list is complete there will be at least seventy members.

The board was organized to perpetuate the work of the Commission composed of Commodore Louis D. Beaumont, president; Major Charles J. Glidden, executive secretary, and Mr. Benjamin Hillman, which organized the First Aerial Derby Around the World. The board will act in an advisory capacity to all interested in aeronautics throughout the world, will assist in the advancement of aeronautics as rapidly as possible and encourage aerial navigation in all parts of the world. Pending a meeting in London in 1921, Major Charles J. Glidden is acting president of the organization.

Raymond Saulnier to Visit America

Mr. Raymond Saulnier, Chevalier of the Legion of Honor and President of the Societe Morane Saulnier of France, will arrive in America shortly to complete negotiations for the manufacture of the Morane Saulnier aeroplanes in the United States.

Temple N. Joyce of Baltimore, Md., has been representing the Saulnier interests in America for the last year anticipating the consummation of constructive plans that will be interesting to American pilots and commercial organizations.

Social Call By Aeroplane

Pilots Turner and Runser, in their swing around the circle in an Avro biplane, are continuing their good work on behalf of educating the public aeronautically.

While in North Carolina recently they were requested by Mrs. R J. Reynolds, wife of the late millionaire tobacco manufacturer, to call at her home and discuss a proposed mail airline from New York to Atlanta. To demonstrate the safety of landing in a small cleared space, the men conceived the idea of making the call by aeroplane and succeeded in landing on the front lawn of Mrs. Reynold's home. It was the first social call made by aeroplane in that part of the South and it aroused considerable favorable comment.

Mexico Buys English Aeroplanes for Army

Mexican press dispatches announce the purchase in London of 35 English aeroplanes by the Mexican consul there on instructions from the Mexican government. The ships are the same as those used by the English on the "Flanders front" and are in good shape. They are to be incorporated into the Mexican army's air fleet.

Navy Sites Around San Diego to Be Inspected By Joint Congressional Committee and High Navy Officials

Great interest is centering around the visit of the joint congressional committee and high officials of the Navy when they arrive at San Diego. The delegation will be headed by Admiral Robert E. Coontz, other officers accompanying him being Rear Admiral Washington L. Capps, member of the commission on establishment of additional navy yards; Rear Admiral Charles W. Parks, chief of the bureau of yards and docks; and Lieut. Com. Harry W. Hill, aide to the chief of naval operations.

All the Navy sites and activities will be inspected in and around San Diego, and it is expected that the work already started will be rushed to completion, and the new plans in mind for the expansion of this base will be executed.

Of particular interest will be the selection of the site for the home of the new dirigible R-38, which is nearing completion at London, and after its trial trips and the proper training of the crew it will be flown across the Atlantic.

Certainly no better training place for lighter-than-air craft could be found than at San Diego, and it is expected that it will be located at the Naval Air Station, where the B-18 and the remodelled C-6 already have their home base. For here training can proceed all the year around, and no treacherous winds or storms can impede the progress of instruction. The honored guests of the city and naval base will arrive here aboard the U. S. S. New Mexico, accompanied by Admiral Rodman, commander in chief of the Pacific fleet.

Congressman Soars Aloft in Navy Blimp

Congressman William Kettner, of San Diego, was the guest at the North Island Station recently. After being personally conducted around the station by Captain J. H. Tomb, commanding officer, a brief hop was made in the Navy's pride, the blimp B-18.

The trim craft, carrying the congressman and commanding officer, piloted by Senior Lighter-Than-Air Officer Lt. Roman J. Miller, circled around San Diego bay and Coronado several times at an altitude of a thousand feet.

From his position aloft the congressman, who has been one of the leading figures in establishing San Diego as one of the most important naval bases on the Pacific, obtained an impressive bird's-eye view of the whole scene of present-day construction operations. The trip over the harbor and the Naval Air Station, besides furnishing much interesting data on the whole of naval developments fast approaching completion, proved to be a decided novelty to the visiting congressman, since it marked his first hop in an airship of this type.

Coker F. Clarkson, general manager of the Society of Automotive Engineers, whose efforts are largely responsible for the establishing of the Washington Branch of the S. A. E.

Mail Pilot Sets a Record

Mineola, L. I.—Elmer C. Davis, a pilot in the United States Air Mail Service, established a new record, November 19, between Cleveland and Mineola, flying the 423 miles in exactly three hours, an average speed of 141 miles an hour. Davis left Cleveland at 11:21 A. M., and landed at Hazelhurst Field at 2:21 P. M. He used a De Haviland-4 plane.

The fastest previous flight was made a month ago by William Hobson, another air mail pilot, who flew the distance in three hours and one minute. Davis was a lieutenant in the Aviation Service during the war and received his training at Kelly Field.

Missing Aeroplane is Safe at Cuba

Havana.—Fears that the hydro-aeroplane Santa Maria, which left Key West at 4:30 o'clock, November 18, for this city, had been lost, were dispelled early November 19 when reports were received that the machine had landed at Santa Cruz, a small port fifteen miles from here. The captain, pilot, and mechanic and six passengers carried by the plane were reported safe.

The trip from Key West to Havana usually can be made by an aeroplane in ninety minutes, and when the machine failed to arrive there was uneasiness here. It developed, however, that the pilot of the machine found the sea off the harbor of Havana too rough, and made for Santa Cruz, the harbor of which is landlocked. Wire communication between Havana and Santa Cruz was interrupted, and this prevented a report of the machine's arrival there.

Los Angeles Speedway Exhibit

Los Angeles.—Successful landing of an army De Haviland-4 plane at the Los Angeles Speedway during the past week guarantees a complete display of government aeroplanes and motors for the Thanksgiving Day automobile races at the Speedway. Some doubt had been expressed of the practicability of landing one of the high-powered planes in the limited space at the Speedway, but with this question settled California automotive and aircraft enthusiasts are insured of a wonderful treat.

Spectators will see types of aeroplanes seldom before exhibited on the Pacific Coast outside a government aerodrome. The machines will be flown to the Speedway from March Field on Monday, November 22nd and will be landed there and parked in front of the main grandstand and to the right of the score board.

The following types will be exhibited by the Air Service:

De Haviland-4, Liberty engine; Lepere, Liberty engine; Curtiss, Hispano engine; Spad, Hispano engine; Thomas-Morse scout, Le-Rhone engine; Nieuport, Le-Rhone engine; S.E.5 scout, Hispano engine.

Most of these machines will be fully armored with machine guns and so far as possible will appear just as they would appear ready to take the air against the enemy. Army officers and non-commissioned officers will be in attendance to explain the various functions of the mechanisms and to answer questions. By this means the Air Service hopes to help stimulate interest in aircraft and indirectly to stimulate recruiting.

A mechanical display of motors and parts near the entrance to the Speedway will be an added feature. Motors will be taken down and set up by trained mechanics for the benefit of the spectators.

Plan Winter Air Races

Los Angeles.—Announcement of a national winter air tournament to be held at Long Beach, Cal., December 25, 26 and 27, with both Eastern and Western entrants for both an aero show and races was made here November 20 at the headquarters of the Aero Club of Southern California, which will conduct the events.

Features, it is said, will be trials for new world's records, for which entries already have been received; a dirigible airship race and a demonstration of load carrying airships capable of carrying a load of a ton or more.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, September, 1920

DIVISION	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST					
													Gallons of Gasoline	Total Time Run	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
New York-Washington	$2,254.17	$329.98	$905.92	$816.84	$556.09	$719.19	$1,470.52	$3,189.67	$2,485.52	$822.89	$311.13	$13,861.92	6,062	hr. min. 203 34	17,492	2.9	$68.04	$0.79
St. Louis-Twin Cities	1,077.99	328.59	935.75	720.58	89.06	754.61	1,875.64	2,283.41	616.91	396.18	396.54	9,475.26	2,990	173 24	12,001	4.0	54.60	.79
New York-Cleveland	3,517.68	322.61	1,186.77	776.40	562.11	1,259.00	2,628.43	3,170.41	3,838.46	2,147.93	481.96	19,891.76	10,496	294 24	22,477	2.1	67.56	.88
Cleveland-Chicago	3,988.75	724.48	984.94	514.43	217.93	1,430.53	1,617.55	3,094.21	2,466.52	1,736.69	481.96	17,257.99	11,748	299 26	24,508	2.1	57.60	.70
Chicago-Omaha	2,589.52	397.11	844.92	597.53	72.70	859.97	2,128.93	3,025.66	5,127.59	400.85	481.96	16,526.74	7,716	287 10	25,585	3.3	57.54	.65
Omaha-* Salt Lake	3,871.66	533.01	1,000.14	589.04	52.01	2,224.32	2,111.14	1,573.32	1,910.91	267.46	1,207.96	15,340.97	10,869	232 22	20,557	1.9	66.00	.75
Salt Lake-* San Francisco	1,505.64	230.88	1,309.76	458.70	77.23	6,288.98	1,691.87	3,165.22	613.16	146.68	909.00	16,397.12	3,996	139 20	9,582	2.4	117.66	1.71
Totals and Averages	$18,805.41	$2,866.66	$7,168.20	$4,473.52	$1,627.13	$13,536.60	$13,524.08	$19,501.90	$17,059.07	$5,918.68	$4,270.51	$108,751.76	53,877	1,629 40	132,202	2.5	$66.72	$0.82

Planes operated on New York-Washington Division:
- Curtiss R4's, equipped with Liberty 12 motors.
- Curtiss JN4D's, equipped with Curtiss OX5 motors.
- De Haviland, equipped with Liberty 12 motor.
- Dual De Havilands, equipped with Liberty 12 motors.

Planes operated on St. Louis-Twin Cities Division:
- Curtiss JN4H, equipped with Hispano-Suiza 8 motors.
- Twin De Haviland, equipped with two Liberty 6 motors.

Planes operated on New York-Cleveland Division:
- Curtiss R4's, equipped with Liberty 12 motors.
- Curtiss HA, equipped with Liberty 12 motor.
- De Havilands, equipped with Liberty 12 motors.
- Dual De Havilands, equipped with Liberty 12 motors.
- Twin De Havilands, equipped with two Liberty 6 motors.
- Martin, equipped with two Liberty 12 motors.
- Junkers (J. L. Larsen), equipped with B. M. W. motors.

Planes operated on Cleveland-Chicago Division:
- Curtiss R4's, equipped with Liberty 12 motors.
- De Havilands, equipped with Liberty 12 motors.
- Dual De Haviland, equipped with Liberty 12 motor.
- Twin De Havilands, equipped with 2 Liberty 6 motors.
- Martins, equipped with 2 Liberty 12 motors.
- Junkers (J. L. Larsen), equipped with B. M. W. motors.

Planes operated on Chicago-Omaha Division:
- De Havilands, equipped with Liberty 12 motors.
- Junkers (J. L. Larsen), equipped with B. M. W. motors.

Planes operated on Omaha-Salt Lake Division:
- De Havilands, equipped with Liberty 12 motors.

Planes operated on Salt Lake-San Francisco Division:
- De Havilands, equipped with Liberty 12 motors.

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*Service inaugurated September 8, 1920.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington	$0.19	$0.23	$0.37
St. Louis-Twin Cities	.21	.27	.31
New York-Cleveland	.23	.28	.37
Cleveland-Chicago	.16	.26	.28
Chicago-Omaha	.10	.20	.35
Omaha-Salt Lake	.15	.32	.28
Salt Lake-San Francisco	.30	.36	1.05
Entire Service	$0.18	$0.26	$0.38

OTTO PRAEGER, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Lynnway Airport Being Organized

The Lynnway Aircraft Corporation at Revere, Mass., is completing a plan to properly develop the Lynnway Airport at West Lynn where accommodation hangars will be erected for cross-country fliers.

The Lynnway Aircraft Corporation has been doing passenger-carrying business on a very successful scale throughout the summer and has aroused considerable interest in aeronautics throughout the state of Massachusetts.

St. Louis to Have Commercial Hangars

As the result of aggressive work by William M Robertson, President of the Robertson Aircraft Corporation of St. Louis, Mo., that city will shortly have a well equipped flying field with two large hangars, one of which will be used as a garage for cross-country planes and pilots flying in that territory will be assured of courteous treatment and the possibility of getting spare parts and accessories.

University of Southern Minnesota Has Aviation Course

The University of Southern Minnesota at Austin, Minn., have inaugurated an aviation course and secured personnel which will insure very thorough tuition in the various branches of theoretical and practical flying. Mr. U. L. Mackey will be glad to supply Aerial Age readers with complete information concerning the scope of this work.

Opportunity for a Pilot

Thomas J. Temple of Medford, Oregon, has written us pointing out an excellent opportunity for a pilot with a passenger-carrying plane to secure an advantageous location for a passenger-carrying business. This would involve an airline between Medford, Oregon and Klamath Falls, Oregon, a distance of 70 miles, both cities having good aviation fields and in close proximity to the Crater Lake Park.

Thousands of people visit this Crater yearly and are obliged to ride in auto stages over the roughest kinds of roads taking a whole day for the trip, whereas by aeroplane it might be made in less than an hour.

The present prosperity of the section would almost certainly insure the success of such an undertaking.

Transair Company Organized

The Transair Company of Key West and Havana has been organized to operate a passenger and express line which it is expected will be in operation early next year.

The company has secured three F5L flying boats from the Navy and they will be reconstructed to carry fifteen passengers.

F. E. Loudy is president of the company, T. G. Lammana vice-president and secretary, and A. G. Augente is treasurer.

Logan Aviation Company in New Quarters

The Logan Aviation Company of Cleveland, Ohio, have located in new quarters at 712 Superior Avenue, N. W., where they represent the Curtiss organization and carry a very complete line of aeronautical supplies.

Mr. Logan reports that the Company has had a very successful season along commercial lines, having undertaken and completed several important aerial photographic contracts in addition to their sales and passenger-carrying work. An invitation is extended to cross-country fliers to use the facilities of the Logan field at Linndale, which is about a mile west of Cleveland.

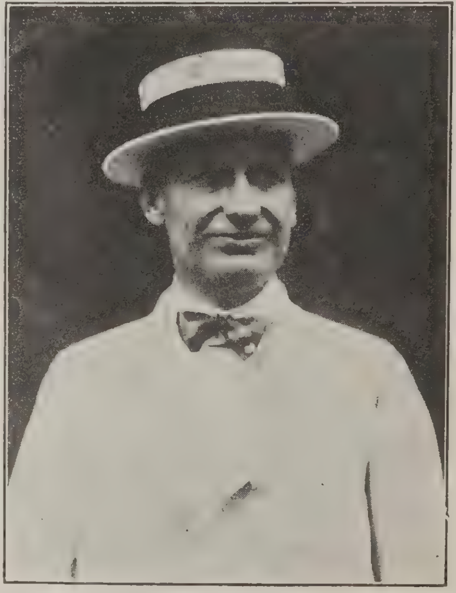
Electric Device for Timing Aeroplanes for Speed Tests

The Aero Club of America has provided facilities for timing aeroplanes for speed tests at Mitchel Field on the days immediately preceding the contest for the Pulitzer trophy. It is an electrically operated device and permits of the most accurate timing to the fraction of a second.

The Air Service will make a speed trial with the powerful Verville machine and, in the presence of the Aero Club officials, it may be possible to set up a record for the kilometer and the mile that will be recognized by the F. A. I. and stand as a world's record for speed.

French aviators, in the past few months, have been vying with each other in repeated attempts to secure the world's speed record. Each succeeding week has brought forth one or more attempt, sometimes successful, to lower the record and hurl man through space faster than ever before.

Should Moseley in the Verville Packard be able to attain a speed of 200 miles per hour, he intends taking the plane in the air some day when there is a wind of fifty or sixty miles velocity and travel, with respect to the earth, at a speed of close on to 250 miles per hour.



Howard E. Coffin who is taking an important part in the organization of an aeronautic section of the American Society of Mechanical Engineers

Excellent Cross-Country Flight

M. H. Steele and F. J. Sonday, of the S. & S. Aircraft Co. of Sparta, Wisconsin, recently flew from Sparta to Nashville, Tenn. in a Standard J-1, equipped with a Curtiss OX-5 motor, in 8¾ hours' flying time. Steele and Sonday will engage in exhibition and passenger-carrying work in the South this winter.

Real Shells Are Fired in Tests

Washington.—Almost daily Langley Field aeroplanes equipped with radiophones engage in firing tests with the anti-aircraft batteries at Fortress Monroe. There is nothing of the sham battle about these tests. Service ammunition is used and bursts close to the planes in order that accurate data may be acquired for use in the event of future hostilities.

These tests are at once spectacular and hazardous. The pilots and observers experience one thrill after another. The observer reports his exact altitude by radiophone, whereupon the batteries fire anti-aircraft shrapnel near the immediate vicinity of the plane, so the observer can report as to whether the explosions occur above, below or to one side. Very accurate data is thus secured in the timing of shrapnel fuses.

The R.80

Whereas the R.80 and R.34 were copies of Zeppelins, the R.80 is an all-British design, except for its Wolseley made Maybach engines.

The most important feature of this ship is her capacity for greater speed than either R.33 or R.34, despite the fact that she is a smaller craft. Airship performance theoretically increases with size, increase in gas capacity being in an advancing ratio to length and girth, thus allowing greater power and achievement of adequate structural strength. It is this capacity for improved speed which is the main hope of airship designers, and in this R.80 is a notable advance. The three airships are compared as regards main dimensions and performance.

	R.80	R.34	R.38
Volume (cu. ft.)	1,250,000	1,980,000	2,720,000
Length (ft.)	530	643	695
Diameter (ft.)	70	78	87
Gross Lift (tons)	382	59	78
Horse power	960	1,250	2,000
Engines	4 230-H.P. Wolselev Maybachs	5 Sunbeams	6 Sunbeams
Speed max. (m.p.h.)	65	62	72
Speed cruising	50	45	54
Range (miles)	6,500	...	9,000

The R.80 has two streamline cars and a longitudinal gangway connects them. There is means of egress to the top of the ship where there is a gun platform. The hull is divided into 15 gas containers with transverse partitions, and the transverse section of the hull is 21-sided. (*Aeronautics*, Aug. 19, 1920. 1½ cols.)

THE LINCOLN STANDARD CRUISER

THE convincing and successful demonstrations given the public by the many passenger carrying enterprises throughout the country have quite thoroughly converted the public to flying as a safe and very rapid means of transportation, as well as being the most enjoyable. In view of that fact the Nebraska Aircraft Corporation has directed its efforts towards producing planes that can more efficiently and economically keep pace with the more stringent and commercial requirements of the aeroplane operators.

The cruiser is an economical plane to operate per passenger mile having a very creditable performance for airline purposes, seating four passengers and having provision for their baggage.

The plane is of a convertible type having a heated cabin for winter flying which is easily detached for summer operation. Exhaustive tests have proved its uniform factor of safety as well as its airworthiness to a sufficient extent to recommend production.

The cruiser was designed by Mr. Vincent J. Burnelli and is the forerunner of a series of cabin types the Nebraska Aircraft Corporation contemplate producing.

General Specifications

Length overall	26′ 4″
Span	41′
Chord	6′
Aspect ratio	6.72
Area	456 Sq Ft
Wing Section	R A F 6
Gap	6′ 2″
Stagger	5″
Angle of incidence	2½ degrees
Dihedral	1½ degrees
Sweepback	4 degrees
Factor of safety	6 to 1
Load per sq ft	7.11 lbs
Weight empty	1800 lbs
Useful load	1350 lbs
Total weight	3150 lbs
Load per H.P.	14.9 lbs
Fuel capacity (60 gals)	4 hrs
Motor	220 H.P. Hispano-Suiza
Climb loaded	5500 ft in 10 minutes
Ceiling loaded	18,000 ft
Landing speed	47 miles per hour
Cruising speed	87 miles per hour
Maximum speed	95 miles per hour
Range	350 miles

Fuselage and Landing Gear

The fuselage is of the girder type, 23 ft. 2 inches long, 34 inches wide, and four feet 10 inches high to the top of the cabin. The longerons are 1 7/16 x 1¼ ash forward and 1¼ square rearward. The motor section longerons are of 1¼ square steel tubing and detachable. The trussing of motor suspension is of 5/32 cable. Double No. 9 piano wire is used to the pilot's seat and single to the sternpost. Aluminum covering is used to the rear of the pilot's seat with linen rearward. The motor cowling is quickly detachable, making the motor very accessible.

The four passengers in the cabin sit in pairs in tandem. The clearance allows good comfort, there being 30 inches forward clearance from the rear of the seats and 31 inches shoulder room.

The lower part of the cabin and seats are generously upholstered with safety belts covered with velvet. Heating of the cabin is provided by two exhaust stoves which circulate a current of air along the exhaust pipes and then to the cabin, dampers being provided to maintain any desired temperature. Ventilation allows the warm air to escape below the rear passengers' seat and past the pilot.

The front dashboard conceals the 38 gallon fuselage tank which extends slightly below the top longerons not interfering with leg clearance. Entrance to the cabin is through a side door and by raising a half section of the roof. A rapid latching device is provided and operated by one handle that securely fastens both doors.

The cabin is of metal entirely and is quickly detachable for summer use, the only extras being the addition of a front and rear windshield. Every attention has been given to weather proofing the cabin in flight or when exposed on the ground.

Variable passenger loads will not affect the balance to any extent. The center of gravity of the passengers passes through the center of pressure of the wings eliminating the possible use of ballast when flying empty.

The pilot is exposed and with cabin on apparently has reduced forward visibility, though extensive operation has proved that the forward visibility is equal to most large engined planes with high forward cowling and double windshields. A speaking tube passes through the windshield opening permitting the pilot to talk with the passengers.

Stick control is used, ease of operation being assured by a control ratio of 1 to ⅝; also the ailerons and rudder being balanced. The aileron control is exceptionally light and sensitive.

Right hand throttle and air pump is provided with left hand booster altitude and shutter control.

In the section back of the pilot's seat is a large baggage compartment extending to the bottom of the fuselage allowing ample room for four suit cases which the weight schedules list at 25 lbs. per passenger. Tools and tool box are carried under the pilot's seat.

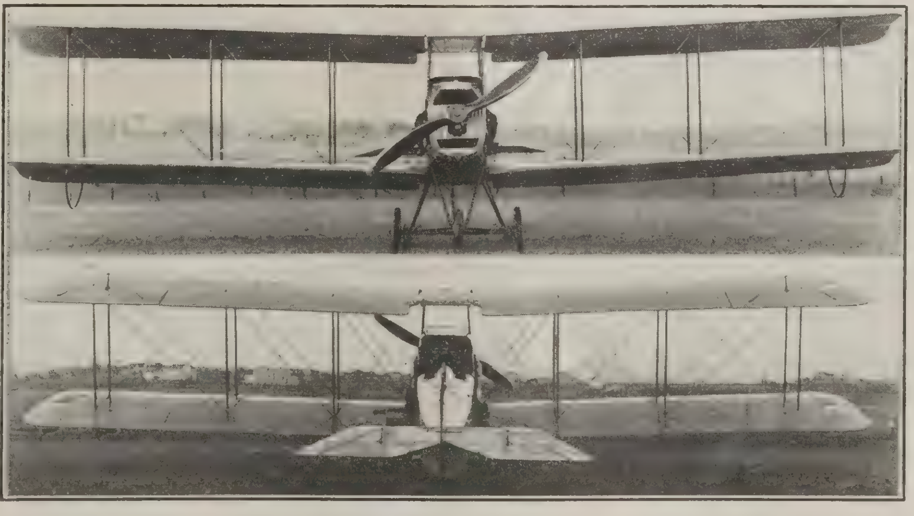
Finish of the fuselage cabin is green upholstering and tapestry. The exterior finish is dark blue in front and silver in the rear.

The landing gear is very rugged in design and of the three wheel variety. The main struts are of laminted spruce and the front wheel struts of steel tubing fared with white wood. The axle is 2 inches, heat treated nickel steel carrying 25″ x 5″ wheels. The front wheel is 20″ x 4″. The tail skid is of the concealed shock absorber type and very low allowing a wide range of angle for slow speed landings.

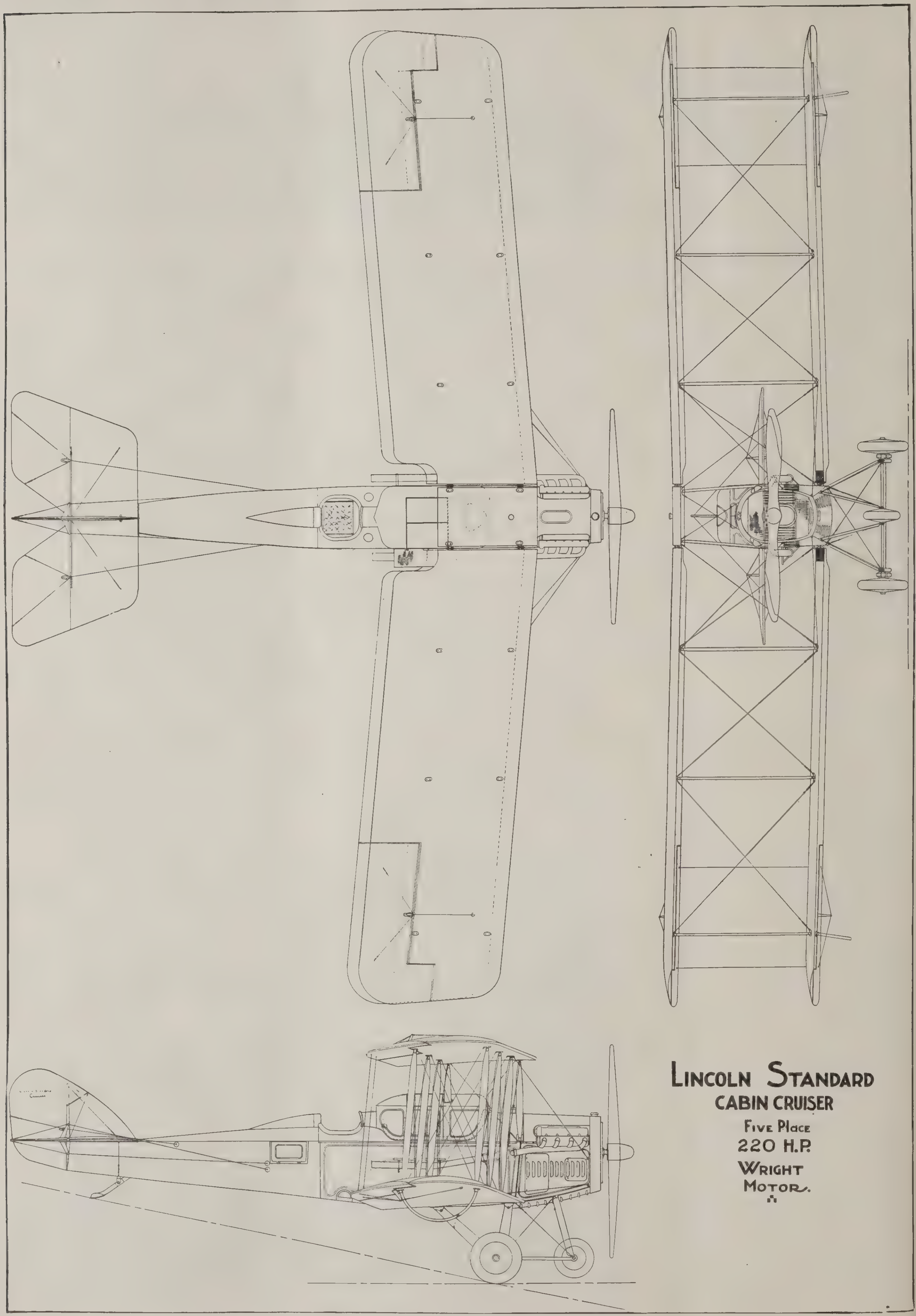
The percentage of tail skid loading is 14 per cent of the total weight which is above the average, though when flying without the passenger load it drops to 8 per cent. The third wheel is provided as a safety measure on account of said variable tail skid load condition, in view of the heavy resistance and rough fields a commercial plane has to frequent at this time. For flying between known aerodromes, the third wheel with its suspension can be dispensed with, as it is easily detached. The finish of the landing gear corresponds to the forward section of the fuselage.

Wings and Empennage

The wings are of the five section type with the main panels interchangeable top and bottom and have six sets of main struts with double lift and single landing



The four-passenger Lincoln Standard cruiser, equipped with a 220 H.P. Wright motor



Lincoln Standard
CABIN CRUISER
Five Place
220 H.P.
Wright
Motor.

wires. Inner lift cables are 3/16, intermediate 5/32 and end ⅛" hard cable. The wings weigh complete with external trussing 1.32 pounds per square foot which is a fairly low weight, considering the factor of safety. The six cellule wing truss permits a thirty per cent reduction between strut stations for a given area, thereby running up the strength to weight ratio to a high degree of structural efficiency at the expense of a three per cent increase in the parasitic resistance. The internal drag trussing is with compression struts half way between strut stations making a six cellule truss for each panel. Double No. 9 piano wire takes the drag load and single for truing.

The spars are of I section with strut stations disposed to obtain a very uniform factor of safety. The ribs are of 3/16 ply wood with 3/16 x ¾ spruce capstrip. The rib spacing in the slip stream is 9 inches and outward 12 inches with 3 auxiliary entering edge ribs between.

The entering and trailing edge is of spruce and stiffeners are of ⅜ dowling, there being three pairs. Two between main spars and one in trailing section.

The ailerons which are double are balanced and interchangeable, having one-eighth their area forward of the axis of rotation. The system of balancing used preserves the uniform appearance and contour of the wings and is very effective in action and does not require a large overhang which is difficult to truss light and rigid.

Four 5/16 eyebolt type hinges are used, two close at the ends and two inward. Outside aileron tillers with two intermediate connecting wires actuate the ailerons. The ailerons drive and compensating cables are of 3/16 flexible and are internal.

All pulleys are visible and accessible through celluloid slides fastened to the fabric. The center section is cut away at the trailing edge and contains a 22 gallon fuel tank, cross wiring being eliminated and substituted with steel bands that pass over the top of the fuel tank. Covering is of four ounce linen with lock stitching which is double in the slip stream, and covered with 2½ inch frayed tape. Finish is with wing enamel light blue on top of surfaces and silver on bottom with black enamel fittings.

The tail unit is of steel and wood construction trussed externally with 5/32 cable. The rudder is balanced and large in area to handle the cabin side area. The stabilizer is adjustable through two sets of screws in the fuselage which permit a negative setting from the regular angle of one degree positive. The covering and finish corresponds to the wings.

Power Plant and Instruments

The motor is a 220 H.P. Hispano-Suiza with geared down propeller shaft. The gear ratio is .75 to 1, the motor turning 2250 revolutions maximum and the propeller 1675 R.P.M. When installed in a commercial plane with sufficient reserve power to permit comfortable cruising with ¾ throttle, the two-twenty is a very durable and flexible motor with surprisingly good qualities, especially if reasonably handled. The above has been proven through numerous tests in the air conducted under the most imposing conditions. The plane under normal flying conditions requires 1450 R.P.M. propeller speed when cruising. The gasoline consumption is .47 lbs. per H.P. per hour, approximately 15 gallons per hour. The oil consumption is roughly 1/20 of gas consumption, there being maximum oil capacity of 6½ gallons. Gasoline feed is by air pressure from the motor pump working into the center section tank then through the fuselage tank. The oil temperature is reduced by the oil circulating through a flat tank oil radiator which is located directly below the crank case. The radiating system contains 12 gallons of water. The radiator is of the nose type, 410 sq. in frontal area, and four inch core. Shutters allow the pilot to maintain an even running degree of temperature of 90 cent. The propeller is a left hand Hamilton brass tipped, 9 ft. 3 diameter with a mean pitch of 6 ft. Altitude control is used in connection with the Claudel carburetor which is an example of simplicity. A booster magneto is used for starting. The magnetos are of the T type mounting, making the breaker box and distributor very accessible. In all respects the motor installation and housing is very accessible, being possible to remove the blocks without disturbing the radiator.

In the pilot's cock pit, a complete set of instruments is provided, compass and banking indicator being figured as standard equipment. In the cabin instruments of interest to the passengers are provided, namely, air speed indicator, altimeter, clock, and thermometer. The air speed indicator is arranged to also serve for the pilot who has clear vision through his windshield to the front dashboard. Instruments on the pilot's dashboard are conveniently arranged for inspection or removal.

FARMERS TO SOLVE H. C. L. BY AVIATION

Poplar Bluff, Mo.—"Flying farmers" of the Ozarks are now fighting the high cost of living from the air.

With a nation-wide clamor for increased production to aid in bringing down food prices, agriculturists in this section who till large tracts of land have taken to the air as a means toward more intensive farming.

This ultra-modern means of overseeing large farms has proven successful, the farmers claim, and they predict the aeroplane will shortly become just as necessary an accessory to scientific agriculture are are the modern planting, threshing and other agricultural implements.

Transportation of farm products in large quantities has not yet been tried, but from their experience in transporting small quantities for their own consumption and to nearby markets the "flying farmers" predict that it won't be long before planes daily skim into the cities with eggs, butter, fresh milk, live poultry and other necessities for the metropolitan consumers. With the difficult question of transportation thus solved, they say, the city dweller will obtain his food at a greatly reduced figure.

When "Old Dobbin" gave way to the "flivver" down in this section of Missouri "old timers" of the Ozarks considered themselves thoroughly modernized. But now the men and women who followed oxen and two-wheeled cars in the pioneer days of Ozark farming gaze in amazement at the "new fangled flying farmers." For the "flivver" is a back number in this "Shepherd of the Hills" country. The aeroplane bids fair to relegate the automobile to the junk heap.

Farming in this section of Missouri is generally on an extensive scale. Some individual land holdings are as large as 2,000 acres, due to many farmers having taken up large tracts of cheap swamp land which has now been reclaimed.

With aeroplanes the farmers can cover twice as much territory. Unhindered by having to stick to roads, they skim across their fields and drop down where their attention is required.

In Sikeston, a colony of farmers who have extensive tracts nearby, a farmers' aero association has been organized. It is claimed as the first of its kind in the world. There are a dozen or more planes kept in Sikeston, with as many licensed farmer pilots. Hangars have taken the place of stables and garages and there is quite a rumpus when the agriculturists drag their planes out after the morning meal for the start to their fields.

Leonard McMullin, the pioneer of the "Flying Farmers," began using an aeroplane after three hours' instruction. He owns three farms within a radius of twenty miles of Sikeston and visits each almost every day.

"I use my plane every day," he told the correspondent. "I am farming 2,000 acres of land, am in the mercantile business, in the mule business and logging contracting business. I found it was absolutely necessary to get around faster to handle them all. I have had but one accident."

THE WRIGHT AERO ENGINES

TO keep really up to date in aviation, an aeronautical engine must change constantly. It cannot remain stationary, no matter how remarkable it was at the time it was first produced.

This system of improvement has been carried along so rapidly by engineers of the Wright Aeronautical Corporation in the case of the Hispano-Suiza engine that it has now reached a point where it is quite a different engine from the one first turned out by the Wright plant in July, 1917. Consequently, the Wright Corporation has changed the name of the engine it manufactures from the Wright-Hispano to Wright.

The great success of allied aces in "Hisso" motored combat machines against the best that Germany could produce in the engine line is well known. The Spad was long supreme as a one-seater on the western front.

But several years have passed since that time, and a year measured in terms of aeronautical improvement is a long time. The Wright Aeronautical Corporation picked the Hispano as the best engine in the world after its experts had studied various types for more than a year. The corporation, however, was not satisfied merely to turn out Hispanos, even after the American rights had been purchased and the Air Service clamored for high production. The first 2,500 made at the big New Brunswick plant were only slightly modified, but these modifications were so successful that a number of changes in design were made, with the consent of the Air Service.

The Hispano as it came to America was as delicate, sensitive and high spirited as a blooded colt. The big defect lay in the relatively low durability. It was, therefore, toward greater sturdiness and reliability that the Wright engineers worked, although they preserved the lightness and great flexibility of the original motor.

The alteration of the Hispano-Suiza which has caused it to become distinct as the Wright motor is thus explained by F. B. Rentachler, vice-president of the Wright Corporation:

"The areonautical engine which we are building today is no more the Hispano-Suiza than the Liberty or Rolls-Royce engine is the German Mercedes. The Wright engine is built around the old Hispano-Suiza just as the Rolls and Liberty hark back to the Mercedes.

"By means of the change the Wright Corporation made in the cylinder construction over the original Hispano, this engine is capable of a life between overhauls as long, if not longer, than of any other aeronautical motor. The corporation was well aware of the criticism against the Hispano, to the effect that the valves were delicate, and set about the solution of this problem. To illustrate the results obtained by the change in cylinder construction, one Wright engine has been running at McCook Field, Dayton, in ordinary flight for more than 150 hours without overhaul, and at last report was still running, causing no trouble. The valves on this engine have never been ground, nor has any other repair work been done."

More than fifteen major mechanical changes and improvements have been made in the "Hisso" by the Wright engineers.

The early French engine had very thin heads in the cylinder sleeves and considerable trouble was experienced with the valves. At first the Wright engineers thought the trouble was due to valve warpage, but careful study revealed that it was due to cylinder head warpage. The thickening of the cylinder head did away with the thin head and permitted expansion without warping. This elimination of warping assured the perfect setting of the valves.

The valves themselves were also somewhat changed in design. The size of the neck was increased to allow a better heat flow sway from the face of the valve, thus keeping it cooler and making it less likely to burn. The design of the cylinder block was changed to allow increased circulation of cooling water around the exhaust valve seats.

The installation of American magnetos and an American ignition system was one of the first changes made.

The design of the pistons was altered completely. The piston pin was changed from the fixed to the floating type. The modified piston does not burn so easily and is a better manufacturing job. The original Hispano had a set screw which held the piston pin place. This, in service, due chiefly to the carelessness of mechanicians, was sometimes likely to drop out, often going through the head of the piston or through the bottom of the crankcase. This permitted the piston pin to rub against the cylinder wall, scoring it and spoiling the motor until expensive repairs could be made. The floating type of piston pin, it has been found, gives better wear than the fixed type.

Changes were also made in the connecting rod and bearing. The French inner connecting rod and bearing were integral with each other. This made for lightest possible construction but defects were that the manufacture of these bearings was exceedingly difficult and their life in actual service was very short even under the best of conditions. The change to the Wright type gave a great increase in duration of this member and also made a simpler manufacturing operation.

A new carburetor for the "Hisso" was also developed. The carburetor has many merits, but the most important is the more complete control of the mixture. This is especially useful in altitude work.

Several changes were made in the magneto bracket until a modification was obtained which made it possible to use a straight engine bed in the plane, simplifying removal and replacement. A change in the vertical shaft, which made for greater ease in manufacture and in timing, was also made.

The French design of the lower half of the crankcase was for a wet sump motor, that is, one carrying its own oil in the lower half of the crankcase. On steep dives or steep climbs this meant that there was danger that the cylinders in front or in the rear would be flooded. The first American modification was to use an auxiliary oil pump placed on the rear of the magneto bracket to make the motor a dry sump job. This was found to be only a makeshift. A later design placed all oil pumps together in a compact unit, easily accessible and properly placed. An oil lead from the front end of the camshaft housing was run back down to the crankcase to take care of the overflow oil when the plane is diving, as well as to prevent the camshaft housing from inundation and possible leakage from the valve stems.

A slight change was also made in the upper half of the crankcase in order to give oil a direct lead to the front thrust bearing. This improvement permits unobstructed lubrication of the bearing, which is very heavily worked, and is also a precaution against possible trouble from partial failure of splash lubrication. The rear end of the crankcase was slightly changed to accommodate the magneto bracket, which is interchangeable on the 180 and 300 horsepower engine.

The design of the water pump attachment and outlet was slightly modified to make them more compact and accessible. A fuel pump for handling gasoline without the use of a pressure tank and air pump has been provided on the bottom of the new magneto bracket, and provision has been made for the installation on the magneto end of the engine of a standard type electric starter.

But although the "Americanized" engine is, in the opinion of many aeronautical experts besides those of the Wright Corporation, as near perfect as is possible in this year 1920, the work of altering, improving and amending is going on ahead as steadily on the Wright motor as on the old "Hisso" from which it developed.

Evaluation of Altitude Records

In the estimation of the height of an aeroplane from the ground, an indirect procedure has usually to be adopted.

If the pressure of the air at the ceiling is known and if the temperature distribution of the air with height has been determined during the ascent, an accurate estimation of the height is possible. Such an estimation is, however, tedious and moreover does not give a clear idea of the performance of the machine, which is primarily a function of the air density at the ceiling. The author strongly recommends the adoption of such a density standard in estimating height records. It is preferable to the procedure of the F. A. I. who measure pressure only. In both cases (pressure or density) it is usual, in order to appeal to the general public, to express the record in terms of actual elevation in feet or metres. Such a translation of a pressure or density reading into an altitude reading is, however, arbitrary depending on the assumed temperature distribution. Some general agreement will, therefore, have to be reached as to the particular function adopted. The author recommends the equation

$$\gamma = 1.250 - 0.1153\ H + 0.003024\ H_2$$

where H = height in kilometres, γ = observed density in kg./m³. This equation agrees tairly well with observation for altitudes above 5 km.

The F.A.I. use a temperature distribution seldom met with in Europe and their deduced heights are largely in error. This is shown by the following figures:—Using the observed temperature distribution of a hot, cold and very cold day (at height), the same air density is reached at 8016, 7764 and 7895 m. respectively—an extreme difference of 252 m. Using the F.A.I. formula, the values are 7507, 7931 and 8228 m., a difference of over 700 metres for identical performance. (E. Everling, *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* May 15, 1920. 4½ cols., 1 table.)

THE HEWITT-CROCKER HELICOPTER

By Professor FRANCIS BACON CROCKER

(Concluded from last week)

Investigators and inventors who have attempted to solve the helicopter problem and even laymen who casually consider it, nearly always regard the obtaining of approximately horizontal motion, especially at high speed, as a serious if not insurmountable difficulty. As already stated, this is largely and probably wholly a bugbear because all kinds of helicopter models and even toys show rapid as well as stable motion in nearly horizontal directions.

The reasons for this physical fact are simple and substantial. Fig. 5 shows clearly that even a small angle of tilt of the axis of the propellers produces a large horizontal force to propel the machine in that direction. At the same time, the vertical component or lift is only slightly reduced. In other words, the cosine of a small angle is only a little less than the radius, whereas, the sine is relatively large for small angles.

This well-known trigonometrical fact is most important in connection with the horizontal travel of helicopters, because it is possible to obtain a large and sufficient horizontal force without material sacrifice of lift. Indeed, experiments show that motion of the air in the plane of the propeller or at a moderate angle thereto largely increases its thrust. Data on this point are not definite, but it is generally believed that considerable increase in thrust results under these conditions.

It is practically certain that horizontal motion of helicopter propellers will much more than offset the small reduction in lift due to tilting their axis, and the gain in thrust will be so large that the lift will actually be greater. Hence, the lift will increase instead of decrease when the machine moves horizontally or approximately so. In this connection it is a paradoxical fact that a helicopter moves more rapidly horizontally when its axis is only inclined a small angle from the vertical, than it moves if its axis is horizontal or nearly so. In short, it travels faster when it is not pointed in the direction in which it is really moving. This is a most interesting and unexpected phenomenon. The explanation is that the pitch and r.p.m. of the propellers of Helicopter No. 1 would give an axial speed of about 25 miles per hour with no deduction for slip. The horizontal force exerted when its axis is tilted 15° is about 1000 lbs. This force is sufficient to overcome head resistance and drive the machine at least 150 miles per hour.

Apparently the large gain in horizontal force and the small loss in lift caused by tilting the axes of the propellers through a small angle has not been appreciated. On the contrary, the favorite argument of experts and laymen against the helicopter is its alleged inability to speed horizontally. This is probably one of its strongest points, as tilting the propeller axis affords a very simple and convenient way to move at or near the horizontal with any desired speed. It can go as fast or as slowly as the pilot wants to travel, which is not possible with an aeroplane. It is the irony of fate that the usual objection urged against the helicopter is likely to prove its greatest advantage.

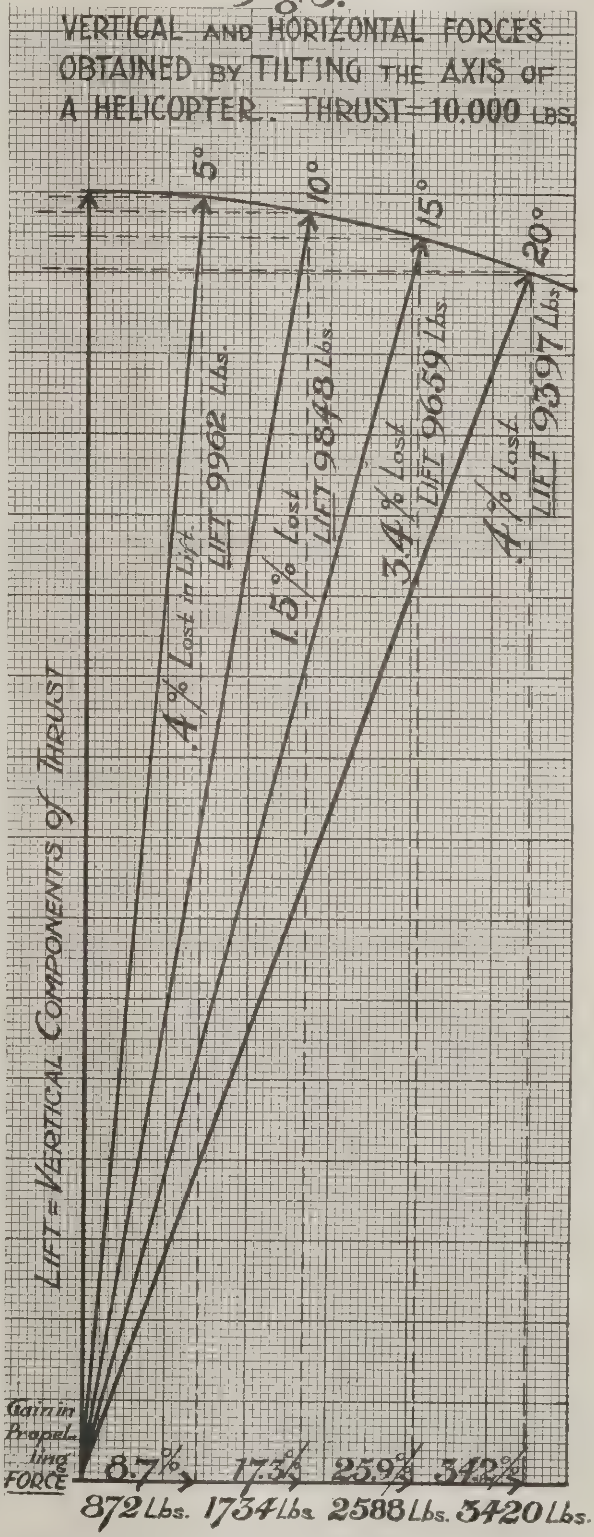
The mistake arises from failure to realize that the force needed to propel a helicopter horizontally is much less than that required to lift and support it.

The other objection raised *ad nauseam* against the helicopter is its supposed helplessness in case "the engine stops". In the first place, the helicopter has considerable ability to act as a parachute, especially, if it travels downward at a considerable angle to the vertical, so as to get the benefit of the side motion of the air already referred to. Authorities differ regarding this point and many of them do not believe that a helicopter has sufficient parachute action to descend to the earth without injury to man or machine. Other authorities, however, believe that it can be made to descend at sufficient low speed so that the occupants will not be injured, even though they do get quite a jolt.

If, however, the propellers themselves are inadequate to serve as parachutes, they have at least considerable effect as such. They could also be supplemented by an auxiliary parachute extending upward from the inner propeller shaft.

We need not, however, worry or even raise a question on this point. It is only necessary to provide four engines, each of which carries a pinion engaging with both gears on the propeller shafts. One of these engines would be a spare unit which could be brought into action by a clutch when any one of the other engines fails to work or needs inspection or repair. In this way one engine could quit entirely and yet full rated power would be available. Even though two engines fail at the same time, the other two would enable the helicopter to descend to the earth at a moderate speed not likely to injure the men in it or the machine itself. One spare engine added to three others capable of developing the full power needed would increase the weight of the power plant one-third, but the necessary fuel, lubricant, radiator, cooling water,

Fig. 5.



Thrust of propellers=10,000 lbs. Force to overcome drag= horizontal component of thrust etc., are not increased, so that the additional weight of power plant would be less than 25% and less than 10% of the total weight of the machine.

Weights of Helicopter No. 1 and of its Principal Parts

Two Propellers:	lbs.
Four tubular steel arms, joints, guy wire anchors, etc.	258.
Four blades, including aluminum ribs, covering, etc..	94.8
Guy wires	77.5
Turn buckles, total	15.7
Propeller fittings, connections to shafts, etc	81.7
Total weight of both propellers	527.7
Two propeller shafts and external tube	242.1
Propeller shaft fittings	77.2
Gearing and fittings	164.4
Motor supports	28.7
Twenty-one ball bearings, total	46.7
Two engines, 100 h.p. each, radiator, water, etc	650.
Fuel, lubricant, containers, etc., for about one hour	140.
Fuselage (has no tail and little bracing)	80.
Control gear	60.
Landing gear	80.
Two men	320.
Instruments, tools, etc	30.
Total weight of Helicopter No. 1	2,446.8
Margin over weight	103.2
Lift actually obtained	2,550.

The conclusive fact demonstrated by Helicopter No. 1 is that aerial propellers of moderate weight and bulk can be successfully constructed and operated, having sufficiently large diameter to give the lift per h.p. at full load needed for a practical helicopter. These particular propellers which are 51 ft. in diam. are of ample strength and work perfectly with no vibration, swaying, fluttering or other objectionable motion or action of any kind and no noise except a little humming sound. They prove beyond question that larger aerial propellers of even 100 ft. or more diam. can be successfully built and run to give as much or greater lift per h.p. at full load without excessive weight.

Helicopter No. 1 was constructed to be equipped with two ordinary aeroplane engines of 100 h.p. each. They can be mounted on the supports provided for them and employed to drive the machine in actual flight, carrying two men for which it was designed and of which it is fully capable in structural strength, lift, etc., as the statement of weights shows.

For testing purposes, however, two direct current electric motors of 100 h.p. each were used. Their weight is too great for flying. On the other hand they enable results to be obtained far more accurately, conveniently and through a larger range than is possible with gasoline engines. The speed can be varied very gradually from the lowest to the highest values and always under perfect control. Moreover the electric motors were accurately calibrated so that the exact power applied to the helicopter is known at any moment from the watts supplied to motors. The lift was determined by mounting the whole machine on platform scales that were verified by known weights. Many careful tests were made at different pitch angles and various speeds of the propellers. The best pitch angle was about 12° and the maximum speed was 71 r.p.m. but the machine is strong enough to withstand higher speed and give greater lift. The results were very consistent and the observations when plotted made remarkably smooth curves in accordance with established aerodynamic principles. For example, the lift—or thrust of the propellers—increased as the square of the r.p.m. and the lower the r.p.m. the greater the lift per h.p. At 33 r.p.m. of each propeller a lift of 560 lbs. was obtained with 14 h.p. or 40 lbs. per h.p. At 71 r.p.m. the lift was 2550 lbs. with 126 h.p. or 20.2 lbs per h.p. This result is used in the statement of weights given above and has a margin of more than 100 lbs. greater than the gross weight of Helicopter NUo. 1 fully loaded. The fact that this machine gave a lift of 40 lbs. per h.p. at a little less than half speed shows that claims of large lift per h.p. have little significance unless the lift is sufficient to carry the gross weight and have a margin.

The lift of 20.2lbs. per h.p. obtained with full load of 2550 lbs. is extraordinarily high. It is about three times greater than the thrust of an ordinary aeroplane propeller. This enormous gain of 200% is largely due to the use of propellers 51 ft. in diam. revolving at 70 to 80 r.p.m. instead of aeroplane propellers of 8 to 10 ft. diam. at 1200 to 1500 r.p.m.

The large diameter and low angular velocity of the propellers of Helicopter No. 1, also the engineering structure and mechanism necessitated thereby, enable it to develop the high thrust or lift per h.p. that makes it a practical success. A helicopter equipped with aeroplane propellers giving their usual thrust (lift in this case) of 7 or 8 lbs. per h.p. is hopeless. Indeed twice that lift would not make such a machine of any commercial, military or even pleasure use.

The lift of more than 20 lbs. per h.p. obtained with Helicopter No. 1 is ample to make it successful for general as well as special aerial service. It is possible, however, to get even better results by adopting a thicker propeller blade section. For example, the American section U. S. A. T. S. No. 10 has a maximum thickness .16 or about one-sixth of its chord, whereas the actual section of the propeller blades of Helicopter No. 1 is Eiffel No. 63 having a maximum thickness .10 or one-tenth of its chord. The thicker section enables the necessary strength to be secured with truss construction and bracing wholly internal to the propeller blade. All guys or other external bracing are thus eliminated. This will also entirely save the large air resistance due to the rotation and travel of these guys and braces, thereby still further improving the action and efficiency of Helicopter No. 1. The thicker blade section also gives greater lift at the same speed and pitch, so that smaller blades or lower speed may be adopted which also increase efficiency.

The Hewitt-Crocker Helicopter is covered by U. S. Patents Nos. 1,350,454, 1,350,455 and 1,350,456, issued August 24, 1920; also by patents in the principal foreign countries. The claims are very broad, being practically the same as in the original applications for patent. In the case of almost every application for patent some of its claims, especially the broader ones, are more or less anticipated and very often completely so. The fact that no material anticipation of the claims for the Hewitt-Crocker Helicopter was found is good proof of its originality. Moreover, it has been described in many popular and semi-technical articles published in daily papers and in magazines both here and abroad during the last six months or more. No one, however, has questioned our claims or asserted that he or anyone else has constructed or even conceived the same or a similar aircraft.

The claims of the patents for the Hewitt-Crocker Helicopter cover the machine as a whole, also many elements or features that are practically essential in a successful helicopter. For example: large diameter propellers; the relation of this diameter to the h.p. employed and to the lift per h.p.; aspect ratio and its relation to other quantities; percentage of disk area covered by the propeller blades; flexible gears; double reduction balanced gearing; reinforcing the propeller shafts between the propellers where the stress is greatest; also other important elements, proportions and quantities in a practical helicopter.

As already stated the many attempts and little success in producing a practical helicopter has created much skepticism regarding it, particularly in the minds of aeronautic experts. This is quite natural because the latter are either balloonists or aeroplanists and the general public gets its ideas from them. There was a similar mental attitude on the part of horsemen and the world in general when the automobile was introduced.

On the other hand the world generally including laymen and aeronautic specialists, appreciates more and more that the aeroplane, while a marvelous achievement, is limited for many in military, naval, commercial and pleasure uses. The chief difficulty is the fact that it must be traveling at about half of its full speed in order to leave or to land upon the ground. It must have this velocity to sustain itself and be under proper control and worse yet, it must have a fairly long and smooth surface from which to start, or on which to land. Even a soft level surface such as mud or sand, is not at all satisfactory.

Starting from or landing upon a regular aviation field is not difficult. With enforced landing or starting, also in starting or landing where a sufficient space is not available, as in a large city or in rough country, there is difficulty and often danger.

The helicopter is free from these serious limitations. It is able to start from or to land upon a very limited area, whether smooth or rough, hard or soft, or peculiar in any reasonable respect. If the pilot of the helicopter approaches what he has selected as a landing place, and it does not suit his fancy, he can go elsewhere and pick out a better place. This is very different from the aeroplane pilot, who, after deciding to land, is moving too fast and descending too rapidly to be able to choose the best place or even a reasonably good place.

Everyone is more or less aware of these limitations of the aeroplane, as shown by editorials in the daily press, in remarks of individuals having no special knowledge of aeronautics, and in the opinions expressed more or less frankly by experts.

In short, the public is beginning to *demand* an air craft reasonably free from such serious limitations. It is a strange fact, but history proves it that when the public demands anything, it generally gets it. For example, the electric street car in place of the horse car was gradually demanded as a practical necessity. This was in spite of very great technical difficulties involved in devising, installing and operating the apparatus, to say nothing of the fact that for several years the electric street railway was known as the "deadly trolley" and numbered its victims by the hundreds.

The case of the automobile is very similar. The mechanical and other practical difficulties of producing a powerful, controlable and convenient auto car are probably greater than those involved in developing any other device that has ever been generally used and proved satisfactory. Even now troubles occur, but are rare compared with a few years ago when dozens of motor cars lined the important roads while undergoing "fixing" of engine, tires or other part.

The helicopter does not seem to have serious mechanical difficulties or limitations to overcome or likely to give much trouble. Undoubtedly it is a much simpler and more easily solved problem than either the trolley electric railway, the underground contact form of electric railway, the automobile or the aeroplane. One tenth or perhaps one hundredth part of the money and brains that were spent in developing any one of these other machines would bring the helicopter to a state of practical success comparable to the automobile of today. In other words, it would be available for use by almost anyone.

A remarkable and valuable advantage of air craft over the motor car is the fact that congestion and regulation of traffic would be far less difficult. A farmer or other householder would not have to leave his farm or garage through a particular piece of roadway, but would have the wide-wide world, in which to go out and come back in any direction and at any altitude that suits him or avoids interference with other aircraft. The air craft has a series of levels extending miles up in the air in any one of which and in any direction it could travel. They can not only avoid other fliers by slightly turning to one side as in the case of surface vehicles, but can go over or under the other machine which might be done as a spectacular performance with motor cars but will not soon become generally popular.

There could be regulations according to which aircraft traveling north would be about a certain height above the ground, those traveling west at some greater or less altitude, and so on with other directions. All aircraft at approximately the same height would be going in approximately the same direction, thus minimizing the danger of collision or interference.

The fact that helicopters can rise or descend vertically or at any desired angle, gives it even greater flexibility, in avoiding other machines than is possible with aeroplanes. The aeroplane does have the choice of many levels on which to travel and many directions in which to go, also much room to manoeuver, compared with the very limited space of even a broad road, which is all that a motor car can hope for. Very often the surface vehicle has to crowd in with dozens of others through narrow streets and around corners with cross streams of traffic at every intersection of the streets. The aeroplane, however, cannot go up or down vertically or at a steep angle, nor can it move slowly or stop and hover, or change its course suddenly at a sharp angle or go backward. All of thes are practical for the helicopter.

The construction of helicopters does not involve any labor or materials that are peculiar or difficult to obtain. They can easily be built in an ordinary machine shop and can be assembled, disassembled or repaired with ordinary skill and facilities. The aeroplane occupies much space in every direction and is so delicately constructed that it is difficult to transport or to store. Even temporarily it requires a hangar or protection from the wind. A helicopter can safely be laid on its side on the ground or deck of a ship, because it occupies little vertical space, the blades being narrow and the whole machine of substantial construction, which no ordinary wind would affect.

While the helicopter can move in any direction, it is at the same time under perfect control and free from instability, danger of diving and other tricks of aeroplanes which cause many accidents. Although a special advantage of the helicopter is its ability to stand still or move slowly, it will also be able to ascend or travel horizontally as fast as the aeroplane. The helicopter has the remarkable capability of exerting lift vertically or pull sidewise at an upward angle, that can be applied to an object on the ground, such as an automobile or cannon stalled in the mud or off the road. It would also be quickly available and useful at a railroad wreck.

The wings of an aeroplane form a line in the sky visible at a considerable distance. The helicopter has no wings and only narrow propeller blades that revolve, and a much smaller fuselage, so that it is invisible beyond a short distance. The helicopter is far less noisy than the aeroplane, because the revolutions of its propellers are not one-tenth as rapid.

The helicopter has all advantages of the balloon in inherent stability, in rising and descending vertically or standing still in the air, without the disadvantage of great bulk, vulnerability, inability to move quickly and visibility of the balloon. It is really a dirigible parachute, but capable of ascending as well as descending. Its propellers, however, being active, their combined area is much less than that of a parachute designed for the same load.

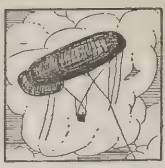
The very fact that the Hewitt-Crocker Helicoper differs so radically from the aeroplane seems to arouse doubt if not opposition. Helicopter No. 1 is devoid of wings whereas the wings of an aeroplane are its most prominent feature.

The ability to voloplane is popularly and technically regarded as its great safeguard. An aeroplane can travel far and descend at a moderate rate by voloplaning without using its propellers at all. Experiments with model and man-carrying "gliders", having no propellers, gave much encouragement and information in pioneer aeroplane work. Most helicopter designs embody wings. Some are merely aeroplanes provided with direct-lift propellers in addition to the usual ones, to enable them to rise vertically or to hover. Others are compromises. For example, in the Demblanc helicopter now being financially aided by the French Government, what corresponds to the wings of a monoplane consist of a propeller with a vertical axis on each side. These are really circular wings rotating about their centers. The blades cover a large fraction of the disk area, so that the machine looks much like a monoplane.

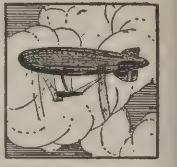
In almost all so-called helicopters the area of the propeller blades or actual wings or their equivalent is relied upon for voloplaning. This is not true of Helicopter No. 1, or only incidentally so, as already explained. Hewitt-Crocker Helicopters will be provided with multiple engines, probably four, one of which is a "spare", so that we have full rated power with one engine disabled or stopped and enough power for safe descent if two and very likely even though three of the four engines are crippled or unavailable for any reason.

This safeguard is far better than voloplaning an aeroplane because the latter must be traveling at a literally break-neck speed when making what is by hypothesis a forced landing on unknown and probably unsuitable ground, as not one tenth of one per cent of the earth's surface is suited to the purpose. The possibility of failure of all four engines at the same time is so remote that the chances of injury thereby resulting are less than those that we take many times every day. Moreover the helicopter is not traveling fast and it is unimportant whether it lands on good or bad ground or in a tree top. It is better to roost there quietly than to crash into it at 30 to 50 miles an hour. Helicopter No. 1 has no wings at all but it gets there just the same. It is a fact, however, that their absence does create prejudice.

Familiarity in mere appearance has great influence upon the human mind. Edison constructed an electric locomotive so long ago that the fact is generally forgotten. Partly as a joke and partly from keen comprehension of human nature, both characteristic of his many-sided genius, he equipped it with a smokestack! No one had ever seen a locomotive without a smokestack, then much more conspicuous than now, so he gave them what they otherwise would have missed. For more than fifty years after steam ships were in successful service they carried not only masts but *sails* that were thought to be needed as a safeguard in case "the engine stops"; the same point is often brought up against the helicopter. Steamers are not built to carry sails now! It is to be hoped that wings will not be imposed upon helicopters for half a century because of prejudice.



FOREIGN TECHNICAL DIGEST



Piston-Cooling for Internal Combustion Engines

The control of piston temperatures in internal combustion engines is of great technical difficulty, and in order to appreciate the conditions which govern the possibility of maintaining the temperature within permissible limits it is desirable to study the transmission of heat from the piston to the cooling water in the cylinder jackets more closely than has yet been done.

The author has made calculations, necessarily of a somewhat approximate nature, yet based on premises which are near the truth. They are too complicated to be given in a brief abstract; but their nature and some of his chief results can be examined. They consist in calculations of the flow of heat from the piston face to the trunk and from the trunk to the walls; account is taken of heat losses to the air and oil inside the trunk. It appears that the temperature falls very rapidly from the working face of the piston in the trunk, the greater part of which is at a sensibly constant temperature. In the case of a 300 mm. diameter by 300 mm. stroke, fast running oil explosion engine having the piston head and trunk 30 mm. thick, and made of cast iron, if the cooling water is 40° C., he estimates that the temperature at the outside of the cylinder walls would be 55° C., and at the inside 85° C., at the rim of the piston 120° C., and at the centre of the piston face 400° C. This corresponds roughly with actual observations on similar installations. For a 350 mm. piston the maximum temperature would be about 100° C. higher.

The outstanding fact is the rapid fall in temperture in the piston trunk; if it were possible to transmit heat to the comparatively cool portion of the trunk from the excessively heated piston head it would be easily passed on to the cylinder walls and the maximum temperature reduced. This can be done in three ways. First, by recessing the piston head, by which means the author estimates that the maximum temperature may be reduced nearly 100° C.; again, by increasing the conductivity of the material. If aluminum pistons were used the maximum temperature would fall to 200° C., or 200° C. less than that of a cast iron piston. The third method is to transfer the heat by artificial means from the piston head to the trunk walls. The method proposed is to lead pipes partly filled with a suitable medium from the head to the walls. The reciprocating motion aided by non-return valves will cause a flow of heat in the required direction. The difficulty lies in the choice of a suitable medium. Water has been tried, but fails because of the vaporization; while oil becomes carbonized and chokes the pipes. The author suggests a metal with a low melting point as suitable, and says that it is desirable to have a specific gravity of about 10, specific heat about .04, and coefficient of conductivity about 100,000. Two pipes about 10 mm. diameter and 100 cm. total length should be used and about 7 cm.^3 space should be left empty. He estimates that in an oil engine 400 mm. by 400 mm. running at 500 revs. per min. the maximum temperature of the piston head would be reduced from 550° C. to 220° C. by this method. The reduction in temperature stresses and increased reliability in working which would result are worth consideration. (W. Schlachter, *Schiffbau,* July 14, 1920, 7 pp., 7 diagrams.)

The Schneebeli Silencer

A description is given of this silencer, which, it is claimed, destroys the sound-waves set up by the exhaust gases without the necessity of introducing baffles or otherwise throttling the gases, which of course sets up back-pressure.

This type of silencer is formed by two chambers *A* and *B* (see sketch), separated by a solid partition *C,* and communicated with each other by hollow fins *D,* into which ports *O,* of suitable diameter, lead. The engine exhaust gases thus pass into the chamber *A,* are split up by the ports *O* and pass into the hollow fins, where they are cooled. They then split up again when passing through the ports O^1 into the chamber *B,* whence they are evacuated.

These silencers can be designed for any duty and may be either double expansion or triple expansion, *i. e.,* with two or three chambers. (*France-Industrie et France-Aviation,* June, 1920. 3 cols., 4 figs.)

Possibilities of the Radial Engine

By a radial engine is meant one in which the cylinders are at equal angles around the crankshaft and do not revolve.

The uses of petrol engines are for (1) stationary work; (2) marine work; (3) road transport; (4) aircraft work. Of these, the first may be ruled out as they mainly consist of single or two cylinders units for agricultural work. In the case of marine work, the necessary attributes are (1) low centre of gravity; (2) low shaft centre; (3) maximum ratio of length and width; (4) water cooling of engine and exhaust and (5) accessibility. The radial engine possesses neither of the first two points, and with the remainder, does not fulfil them so well as the V-type or the vertical type engine. As regards road transport, the necessary requirements are low weight-power ratio, small size, silence, ease of mounting and accessibility. In the first item, the radial engine is far ahead of other types. Silence depends on design, but accessibility and ease of mounting is not so good in the radial engine. For aircraft work, however, this type is largely to the fore, and the weight is very low per horse power, and the mounting on the fuselage is also easily arranged for. Concerning the question of cooling, air-cooled engines can be employed with great advantage, as the air can be directed by cowling to the cylinder heads. Aero dynamically, the head resistance of the radial engine may be low.

The author then proceeds to discuss the various points of radial engine design, including crankcases, crankshafts, cam and valve actions, cylinders and lubrication. (Capt. J. B. Swan, *Automobile Engineer,* Aug., 1920.)

Behavior of an Aero-Engine at Different Air Densities

The author shows that with the usual amount of pre-heating of the charge, the horse-power should vary as the density of the outside air.

The b.h.p. will fall off faster, since part of the losses are independent of the air density. This assumes that the mixture remains constant. The variations in the decrease of power with altitude observed in practice are chiefly due to variation in mixture strength or distribution. Their effect on power should be tested by experiments on the ground.

Flight tests call for the development of an efficient transmission dynamometer between engine and propeller. (O. Schwager, *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* May 30, 1920. 3⅓ cols., 2 diagrams.)

Civil Service Opportunity

The Director of the United States Civil Service Commission, Washington, D. C., request that we announce an open competitive examination for aviation supply expert which will take place on December 8, 1920. Such experts in Grade 1 are paid from $1800 to $2400 a year and in Grade 2 from $2400 to $3000 a year, and from the successful list of entries vacancies in the office of the Chief of Air Service, War Department, will be filled.

Complete information concerning requirements for this examination can be had from the Civil Service Commission in any city or directly from the United States Civil Service Commission, Washing, D. C. Application Form No. 1312.

A Fokker Six-seater Limousine Monoplane

This machine, known as the V 45, to carry six people including the pilot, is fitted with a B.M.W. engine of 185 H.P. which is mounted behind circular radiator.

The pilot, seated immediately behind the engine, has a good view forward and downward, but his view aft and upward is obstructed by the cabin and wings. The leading, and trailing edges of the wings taper, and the balanced ailerons are small. The wings are supported by the fuselage and by three struts extending outwards about five feet on each side. The undercarriage is of very substantial design, the struts consisting of steel tubes forming a letter W in side elevation.

The tailplane and elevators, which also are small, are mounted on the top longerons of the fuselage above the line of thrust and level with the wings. A large balanced rudder is hinged to the sternpost. The main characteristics are:

Length overall	37 ft.
Span	42 ft. 10 in.
Area	451¼ sq. ft.
Weight empty	2,640 lbs.
Weight fully loaded	4,180 lbs.
Climb	13,200 ft. in 45 min.
Maximum speed	93 m.p.h.
Radius of action	744 miles
Load per sq. ft.	9.3 lbs.
Load per h.p.	22.6 lbs.

(*Flight,* Aug. 26, 1920. 2 cols., 3 figs.)

NAVAL and MILITARY AERONAUTICS

Dirigible Zodiac Makes Two Trips to Washington and Return

The Army's largest dirigible, the Zodiac, made two trips during the past week to Washington, D. C., and return, where it maneuvered over the city and gave the large crowds their first opportunity of seeing a big dirigible in flight. During the trip motion pictures were made of the scenes below which will be incorporated in a very interesting picture showing the entire details of a trip in a dirigible.

During the entire trip the big dirigible was in constant radio communication with radio stations at Langley Field and Washington. The radio telephone was used.

Sixty-six Graduates from March Field

Temporary discontinuance of preliminary flying training, transfer of 66 graduate cadets to advance schools and preparation for the next class of student officers has somewhat retarded flying activities in March Field during the past week. One hundred and nineteen flights were made by 25 different ships covering an approximate mileage of 9,125. One hundred and eleven hours and 35 min. flying time were consumed.

Advance instruction required 31 hrs. 35 min.; forest fire patrol, 45 hrs. 40 min.; test flights, 2 hrs., and miscellaneous flights 32 hrs. and 20 min. Preliminary instruction will be resumed again November 1.

Flying Training for Newly Commissioned Officers

The following instructions with regard to newly commissioned officers will be of interest:

With the recommissioning in the Regular Army from civilian status of a large number of pilots of varying experience and flying qualifications, the decision as to their needs in flying training will be left to the Commanding Officer of the station to which they are ordered.

All station commanders to whom newly commissioned officers report will carefully investigate the qualifications, experience and ability of each officer and will take such steps and make such recommendations as will result in the necessary training being given in each case as will qualify the officer for the duty he should perform.

In the case of pilots, in each case his previous training, experience, length of time off flying and present ability in handling a plane as determined by dual instruction, will be considered.

If in the opinion of the Commanding Officer, a reasonable number of flights with an experienced pilot will bring the new pilot back to proper flying form, this may be done, but if the new pilot needs a refresher course at the school or more dual instruction, the same will be reported, and he will be sent to pilot school for complete course.

Flying Time March Field

Twenty-three ships from this school made a total of 136 flights during the past week covering approximately 9,910 miles. Completion of the preliminary cadet course somewhat diminished the total flying time. In all 133 hrs. 10 min. were consumed in flight; 31 hrs. 10 min. for preliminary instruction; 44 hrs. 50 min. for advance instruction; 50 hrs. 05 min. consumed in miscellaneous flights.

Air Service Plane Witnesses Naval Bombing

Aeroplanes from Langley Field participated in the bombing of the battleship Indiana when they flew over the target for the purpose of witnessing the bombing of this discarded ship by Naval aircraft. Dummy bombs were dropped for the purpose of determining percentage of possible hits at various altitudes.

The target was about 60 miles up Chesapeake Bay and the aeroplane observers had no trouble in keeping in direct touch with Langley Field by radio while they were in the air.

Complete Work With Anti-Aircraft Batteries

The past week was the completion of Air Service co-operation with anti-aircraft guns at Fort Monroe where aeroplanes have been furnishing important data to the artillery men. The aeroplanes have been flying over their prescribed course at various altitudes while the anti-aircraft guns have fired at points within 400 or 500 yards of them, the aeroplane observers reporting as to whether the busts of the shrapnel occurred above or below the level of the aeroplane. The radio telephone was used in the aeroplane and at the battery commander's direction and the pilot could promptly report his operations as to the bursts.

This is the first time that anti-aircraft battery commanders have had the opportunity of getting accurate data on the timing of anti-aircraft shells.

Radio Phone Gives Speech and Hearing to Aviation

The growing usefulness of the radio phone in its application to aviation exemplifies itself every day. By enabling the flier to keep in constant communication with the earth, it gives him speech and hearing and, by so doing, keeps him apprised of weather and other conditions ahead. The psychological effect upon the flier of this invisible link with the earth, this intangible evidence of "human touch," is incalculable. To a very decided degree it reduces the sense of hazard as it actually minimizes the danger by affording him indubitable evidence of physical conditions to be encountered throughout his route.

In recognition of its importance to aviation, the Belgian, French and British governments have established a line of phone stations following the Paris-London and Brussels-London air routes. Stations now operating are located at Croydan, just outside of London, at Lympne, on the English side of the Channel, at a point off the French coast, and at Paris. Preparations are also in progress to establish other stations at convenient intervals in England and France.

Transformation Flying, First Pursuit Group

The pilots of the First Pursuit Group are still engaged in transformation flying, and the following types, Spad XIII, Fokker and D.H.-4-B, are seen daily about the airdrome.

Due to the shortage of gas, several cross-country flights had to be abandoned.

Several practice acrobatic formations led by Lieutenant Tourtellot have flown about the vicinity of the airdrome with marked success while the Cadet Detachment put on several good battle formations between Kelly Field and Brooks Field.

The usual exercises in aerial acrobacy have been carried out and, in addition, several interesting combats have been engaged in by the cadets who are close to the time set for their graduation.

The work and accomplishments of the Cadets assigned to the First Pursuit Group have been noteworthy. These seven cadets not only have led the Group in flying time but have, in addition to maintaining their own ships, policed their grounds, ships and hangar while engaged in the sports of the Field on the side. Cadets Laas, Brown and Taylor have also gone in for athletics.

The Group has been in constant daily liaison with the 12th Cavalry on their practice march from Del Rio, Texas, to San Antonio and return. Maneuvers have been practiced with them. The communication has been by Panel and message dropping. They camped two days at Kelly Field. During their stay here, Lieuts. Plumb and Woodward and Cadet McDaniel gave all of the officers of the regiment a sight-seeing ride. The landing Field at Camp Travis was used for this work.

Lieutenant Plumb has been doing excellent work carrying and delivering the Cavalry mail on the march.

Preparations are going forward to send a flight to Fort Crockett, Galveston, Texas, to observe for them in their annual fall firing.

Pensacola Station News

The Aircraft Radio officer has placed a day and night watch at the radio compass station, where records are being kept of State conditions which are being used by the Aerological officer in connection with the detection and approach of thunderstorms and cyclonic disturbances.

A miniature kite balloon has been received for aerological research work; its capacity is 6,000 cu. ft.; it has expanding gores on its sides to take care of expansion due to altitude, instead of automatic pop valves. This aerological kite will be flown from an electric winch especially prepared for the purpose. Its purpose is for obtaining records of wind, humidity and temperature aloft. It is thought that it has sufficient free lift to carry the necessary aerological instruments and a light cable to about 5,000 feet. This will be a useful kite for aerological information when flown astern of vessels at sea where methods by pilot balloons and theodolites fail.

FOREIGN NEWS

Many German Aviation Companies

The Handley Page Berlin correspondent reports that the German Government Air Transport Department has published the following list of 37 companies as being licensed to carry on business in Germany, in connection with the German Civil Aviation Industry both as regards manufacturing and aerial transport:

Casparwerke G.m.b.h., Travemunde-Priwall; Luftfahrzeugbau Schütte-Lanz, Zeefe bei Konigswusterhausen; Deutsche Luftreederei, G.m.b.h. Sommerstrasse, 4 Berlin, N.W.7; Kondor-Flugzeugwerke, Berlin-Charlottenburg; Deutsche Flugzeugwerke, Leipzig; Albatros-Werke, Johannisthal Berlin; Daimler-Motorengesellschaft, Shidelfingen, Sablatnig-Flugzeugbau G.m.b.h., Bellevuestrasse 6a, Berlin, W.9; Hannoversche Waggon-fabrik, Hannover-Linden; Rumpler-Werke A.G., Johannisthal, Berlin; Junkers-Flugzeugbau A. G., Dessau; Luftfahrzeug-Gesellschaft G.m.b.h., Kleiststrasse 8, Berlin, W.62; Bayrische Rumpler-Werke, Augsburg; Badische Luftverkehrsgesellschaft, •Baden-Baden; Nordflug-Werke, G.m.b.h., Teltow; Luftbild, G.m.b.h., Unter den Linden, 56 Berlin; Roland-Maschinenbau, G.m.b.h., Rognitzstrasse, Berlin-Charlottenburg; Germania-Flugzeugwerke G.m.b.H., Luftschiffhallen, Leipzig; Luftverkehrs-Gesellschaft, Berlin-Johannisthal, Damm, 102/104. Gross-Berlin; Deutsche Luftfahrts A. G., Frankfort-on-Main (branch at Friedrichshafen); Automobil und Aviatik A.G., Leipzig-Heiterblick; Märkische Luftverkehrs G.m.b.h., Neuruppin; Paul Strähle, Schorndorf in Wurttemberg; Sachsische Luftreederei, Dresden; MagdeburgerPassagierflug-Gesellschaft, Joh. Eckert, Magdeburg; Siemens & Halske A.G., Siemensstadt bei Berlin; Luftreederei Magdeburg, G.m.b.h., Magdeburg; Luftbildvermessungstrupp der Landesaufnahme, Adlershof; Luftreederei Max Schüler, Heidestrasse 14, Berlin, N.W.; Bayrische Luft-Lloyd G.m.b.H., Munich; Werner von Heeringen, Dorotheenstrasse 68, Berlin; Zeppelin Werke G.m.b.H., Staaken bei Spandau; Zeppelinwerk Lindau, G.m.b.H., Friedricshafen-Seemoos; Dantziger Luftreederei, Danzig; Deutscher Luft-Lloyd, Sternplatz 4, Berlin-Johannisthal; Schweriner Industriewerke, G.m.b.h., Schwerin in Mecklenburg; Ostdeutsche Landwerkstatten, Siedlungsgesellschaft, Seerappen, G.m.b.h., Seerappen bei Konigsberg.

Belgian Aero-Technical Laboratory

An official Aero-Technical Laboratory has been established by Royal decree at the Belgian Ministry of Aviation. The Director is to be Mons. E. J. Amtard, pilot, aviator, electrical engineer, and professor at the University of Brussels.

A New Belgian Aerodrome

It has been decided to establish in the near future an aerodrome in the neighborhood of Courtrai. The school of pilots which is at present at Asch is to be transferred to the new flying grounds, which will also serve as an auxiliary aerodrome for the Brussels-London service.

Trade That Goes by Air

The variety of things which travel by air in the Handley Page aeroplanes to the Continent and back is infinite. Recent live-stock passengers include dogs, cats, pigs, fowls and live lobsters, while the following list will convey some idea of the extent to which traders are making use of air transport: Fruit, fresh flowers, orchids, preserves, poultry and grouse for the table, tinned rabbit, rum, artificial flowers, chocolate, jewelry, furs, coats, trimmings, handkerchiefs, robes, blouses, hats, silks, underwear, lace, clothing, mantles, hand-bags, jackets, skins, woolens, buttons, shirts, waterproofs, leather goods, ladies' transformations, blankets, tapestry, glasses, gold watches, metal lace, photographs, cigars, toys, tissues, films, picture frames, printing blocks, carpet sweepers, books, newspapers, wall paper, printer's proofs, carbide, aero parts, motor parts, die castings, spanners, monotype parts, belting, valves, oil, steel bars, hose piping, photographic cameras, carbon brushes, electrical gear, commercial papers, show cards, printing powder, vaseline, vaccine and gramophone records.

Men Threaten Seizure of Blériot Factory

Paris, Nov. 16.—Dismissed workmen of the Blériot aeroplane works attempted to storm the plant with the purpose of occupying and operating it for the benefit of the employees. The workers were repulsed by the police. A committee which was sent to discuss the situation with the Blériot officials was unable to come to terms and gave the company notice that unless the works reopen the men themselves would operate them. The Blériot works had closed down indefinitely, throwing 2,000 persons out of work.

Bi-Weekly Service to Spain and Morocco

Letters and postal packets up to 6 2/3 oz. in weight, for the bi-weekly service by air to Spain and Morocco, via London, Paris and Toulouse, are accepted by all French post offices at the following air fees in addition to the ordinary postage: Up to 20 grammes, 1 fr. 25; above 20 grammes, but not exceeding 100 grammes, 2 frs. 50; above 100 grammes, but not exceeding 200 grammes, 3 frs. 75. Envelopes and packets must bear the words, boldly written, "Par avion de Toulouse." Passengers are booked to Paris by the Handley Page Transport, Ltd., at the usual London-Paris air rates; it is then necessary to book from Paris by rail to Toulouse, as there is no air service at present between Paris and Toulouse. The fares from Toulouse are as follows:—

Toulouse to Barcelona, or vice versa	468 francs
Toulouse to Alicante	924 francs
Toulouse to Malaga	1,068 francs
Toulouse to Tangiers	1,320 francs
Toulouse to Rabat	1,560 francs
Toulouse to Casablanca	1,680 francs
Rabat to Tangiers	468 francs
Rabat to Malaga	648 francs
Rabat to Alicante	1,068 francs
Rabat to Barcelona	1,320 francs
Tangiers to Malaga, or vice versa	348 francs
Tangiers to Alicante	924 francs
Tangiers to Barcelona	1,260 francs
Malaga to Alicante, or vice versa	336 pesetas
Malaga to Barcelona	564 pesetas
Alicante to Barcelona, or vice versa	336 pesetas

The above rates do not include insurance or hotel.

Handley Page Records

Continental Air Services (in conjunction with Cie. Messageries Aêriennes), September 2, 1919-October 30, 1920.

Passengers carried (Exclusive of mechanics)	3,932
Freight carried	199,885 lbs.
Mileage covered	302,040 miles

Destruction of German Airships

Mr. Lloyd George, replying to Sir W. Davison in the British House of Commons, said the value of airships destroyed by Germans since the Treaty of Versailles could not be accurately estimated until the plans had been surrendered, but the airships would either be replaced or compensation exacted in some other form. There had been no destruction of naval ships since the treaty.

Russian Giant Airship

M. Makhonin, the engineer, has elaborated a plan for the construction of a giant airship.

The motors of the airship will be of 24,000 h.p., and its freight-carrying capacity nearly 1,000 tons. It will have several berth decks, and a lift will provide communication between them. A motor-car, an aeroplane, and a motor-boat will be carried.

This new airship will be capable of carrying 1,000 persons, and her speed will be 66 miles an hour.

Martinsyde Affairs

Messrs. Martinsyde state, with reference to the appointment of a Receiver:—"Owing to circumstances over which the company had no control, and more particularly owing to the pressure brought upon us to pay Excess Profit Duty, our bankers felt compelled to protect their assets by taking this step, which will give them priority over E. P. D. and indirectly protect creditors' assets. It is the bankers' expressed intention that the Receiver should carry on the business as heretofore, under the same management, and the state of our business, in spite of the general trade depression, gives every indication that the debts due to creditors will be satisfied, provided that their co-operation can be relied upon. If the situation alters to their detriment we will immediately notify them, so that they can take any steps they think necessary to protect themselves."

Aviation Firms to Furnish Monthly Reports

It has been decided in future to issue all Canadian aviation firms with suitable forms upon which to report monthly to the Air Board the flying time, number of passengers and goods carried, routes followed, machines used, etc., so that the board will have a continued report of the progress of civil aviation throughout the country. These firms will also be asked to report minor accidents as well as the major ones, in order to enable a more complete record to be kept.

The superintendent of the certificates branch reports continued progress made in the survey of a trans-Canada air route. It has been decided to push ahead at the same time with the following as fast as possible: Ottawa-Borden, Montreal-Ottawa-Toronto-Windsor, Port Arthur-Winnipeg, Montreal-Halifax, Sudbury-Ottawa.

Aircraft for Canadian Pulp and Paper Industry

Operations at Lake St. John are being carried out in accordance with orders. Some interesting flights have been made, and representatives of various pulp and paper companies have been taken up at the request of the Quebec Government and shown the timber limits. Great enthusiasm was expressed for the use of aircraft in their work, the representative of the Belgo Pulp and Paper Co. in particular stating that he had seen more of interest to him in one flight of two hours than he could have seen during the entire season from canoes.

Fruits of the Labrador Expedition

Major D. Owen, of Annapolis, N.S., who accompanied the aeroplanes and flying boat which about a year ago visited Labrador, states that 15,000 aerial photographs of the country were taken, and elaborated estimates of over 2,500 square miles of the country made. The expedition found that behind the twenty miles of coastline there lay one of the most generously forested regions in Canada.

Aircraft for R. C. M. P.

As the result of certain successful experiments carried out under the Canadian Air Board, the Royal Canadian Mounted Police officials at Ottawa are planning to use aeroplanes and flying boats extensively for outpost duty. Comparisons made at the capital on the Belcher Islands flight show what could have been accomplished over the week-end would take the police one year to do.

Progress at Vancouver

Lieut.-Col. Leckie, Superintendent of Flying Operations in Canada, reports that work on the station at Vancouver is now well advanced. The work of erectinig the H.S.24 flying boat has begun, and delivery of the first F-3 flying boat has been made from England. Agreements have been entered into with the Department of Fisheries to carry out a fishery protection patrol.

Flying at Morley

Flying has begun at Morley, Canada. Three D.H.9a machines and one Avro have been received, and are in process of erection. An aerial demonstration was carried out recently for the benefit of a convention of engineers and surveyors at Banff. The flight was entirely successful, but one D.H.9a crashed in landing. A court of inquiry has been convened, and the result will be published in due course.

The Brennan Helicopter

The helicopter on which Mr. Louis Brennan, the inventor of the mono-rail gyroscopic train, has been experimenting at Farnborough for more than a year is shortly to be officially tested.

It is understood that not only has the British Government financed Mr. Brennan's helicopter experiments, but also has offered him an unprecedented reward if his invention proves successful.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

CLUBS

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A Three-foot Curtiss Flying Model

SCALE models are always difficult to balance and adjust for flight, more especially the rubber-driven type, because of the tendency toward "tail heaviness" and twisting of the fuselage. Compressed air models, on the other hand, although being rather difficult to construct, are much more easily balanced and nearly approximate the balance of a full size aeroplane. Several types of compressed air driven models have made their appearance in the last few years, but there seems to be a limited variety of engine designs.

A new departure is noticeable in the model designed and built by R. D. Barr, of Buffalo, N. Y., who has had exceptionally fine flight results. Mr. Barr's design is a Canadian Curtiss, and many of the details, including the engine, have been brought down to correct scale. The engine is not only built to resemble the Curtiss OX type, but is arranged to run by compressed air and to actually be a source of power for flight.

The following is a list of the model's dimensions:

Wing Span (upper)	36″
Over-all height	10¼″
Over-all length	21″
Wing chord	4½″
Gap between wings	5″
Weight, complete	21½″ oz.
Propeller diameter	10″

The fuselage is built up so as to contain a compressed air tank of unique design. All the fittings, seats, landing gear, shock absorbers, etc., are similar to those used on a large ship.

Engine

The engine is an eight cylinder V type. The cylinders have a bore of ⅜″ and a stroke of ½″. Cylinder heads are equipped with a dummy valve action of the usual type of Curtiss engines, but beneath them is the regular rotary valve action. The engine turns up about 2,000 revolutions per minute.

Air Tank

For supplying the engine, a compressed air tank is carried in the fuselage. The air container is made of a piece of rubber inner-tube with both ends closed by vulcanizing. In making the container it is inflated with air until it assumes a cylindrical shape, after which it is wound with light steel piano wire. Ends are formed of metal caps soldered to the wire wrapping.

Performance

When pumped to its full capacity the air tank carries 150 pounds air pressure. The longest single flight claimed for this machine is 1,670 feet, and the best average flight 1,000 feet. All the control surfaces are rigged up to dual control sticks in the body and they may be set to any desired position and locked during flight. The usual altitude attained during flight varies from 150 to 250 feet.

The builder is now preparing a separate description of his engine, which we believe our readers will find interesting. Mr. Barr is willing to give information to anyone interested in his developments, and letters addresed to him at 411 West Ferry street, Buffalo, N. Y., will be gladly answered.

Drawings for Building Scale Flying Models

Many requests have been made recently for additions to the series of flying model drawings which have proven so popular on this page. Reports have come in from many parts of the country telling of the success that has attended the building of these models, and indications are that boys will wish to continue building all the well known types of American and foreign machines.

It is our intention to supply model builders with whatever plans that seem most in demand, and we will welcome suggestions as to the types preferred. Obviously, it will be impossible to supply all of the types mentioned, but we will make effort to publish those desired by the majority.

So that readers will know what scale models have already been described by this department, the following list is given:

Vol. 10	No. 6	Loening Monoplane (American)
Vol. 10	No. 8	Curtiss HS 2L Flying Boat (American
Vol. 11	No. 3	Handley Page (British, American Engine)
Vol. 11	No. 6	Caproni Biplane (Italian, American Engine)
Vol. 11	No. 7	Sopwith Triplane (British)
Vol. 11	No. 10	Spad Biplane (French)
Vol. 11	No. 14	De Haviland (British, American Engine)
Vol. 12	No. 4, 5, 6	Curtiss JN 4B (American)

The machines that have already been suggested to us by a few of our readers are the German Fokker and the British SE 5. The Fokker design has recently been adapted by the U. S. Air Service to take the 400 H.P. Liberty engine, and it is likely that machines thus modified will be observed in various parts of the United States. The British SE 5, equipped with a 150 or 180 H.P. Hispano engine, is familiar to all model builders who have been fortunate enough to visit the army training fields.

Address all communications to the Model Editor, AERIAL AGE WEEKLY, 280 Madison Avenue, New York City.

How to Figure H.P. of Rubber Strand Motor

Designers of models driven by rubber strand may figure out the horsepower developed by means of the following formula mentioned by Mr. Camm, the well-known modellist of England:

Assume a propeller with 500 turns which runs down in 20 seconds. Pitch 15 inches. Thrust (measured on spring scale or other means) 3 ounces. Speed of rotation, 1,100 rev. per minute. The number of foot pounds developed is:

$$\frac{3 \times 1{,}100 \times 1.25 \text{ (ft. pitch)}}{16 \text{ (ounces)}} = 258 \text{ foot lbs.}$$

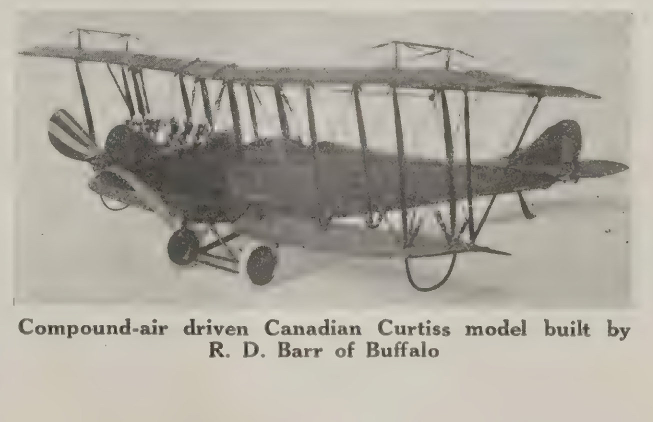
then the energy actually developed is:

$$\frac{258 \times 20}{60} = 86 \text{ foot lbs.}$$

and the power developed is:

$$\frac{258}{33{,}000} = .0079 \text{ H.P.}$$

It will be understood that this power is obtained of a duration of only 20 seconds.



Compound-air driven Canadian Curtiss model built by R. D. Barr of Buffalo

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

SPECIAL CORRESPONDENCE

We are in receipt of the following letter from Mr. A. M. Hendle, of Salt Lake City, enclosing a poem which he asks us to print. We will go him one better and print letter and all.

Aerial Age Weakly,

Gentlemen:—

i incloze a poam wich i wrote the uther nite & wich i wish you can print in your paper. if you can not print it will you plese sent it back to me & i will send it to some other plase ware they can uze such articals. i made it up out of my own hed.
with manny thanks, i am yrs trulie,

a. m. hendle.

The poem follows:

The aireoplane is the gratest thing,
wich ever flue the air,
at getting off the ground,
you betcher life its thair.

i seen won wonce and "Oh" said i
"look at the darn thing go"
it flue up almost too the skie
(i cant think of anny rime for go)

So some day i will by won
and fly it awl myself
i reely aught to try won
(i cant think of anny moar rimes, thank you).

Modern Melodrama

The Villain—What is this I see coming to foil muh in muh rewenge? Ah, 'tis an aeroplane!

Second Villain—'Tis Wright!

First Villain—Curtiss!

(20 years at hard labor!)

B, George! I do believe there's a boat going to come through this canal!
PAY TOLLS HERE
PANAMA CANAL
AERIAL EXPRESS
F. FOX.

Why worry over canal slides when things will soon be like this?
—Courtesy N. Y. Eve. Sun

Aviation isn't so new when you stop to think. A man in the Seventeenth Century built a chimney and flue.

Yes, and even in Napoleon's time, whole armies took to flight! Then again, many people get an inflated opinion of themselves and go up in the air.

Easy

During one of the aviation meets a young woman went through the hangars and after asking the usual foolish questions that aviators have to answer during a tour of inspection, she wanted to know:

"But what if your engine stops in the air——what happens? Can't you come down?

"That's exactly the trouble," responded the willing guide. "There are now three men up in the air in France, with their engines stopped. They can't get down and are starving to death."

Among the Clouds

"Tom, stop that!"

"Why?"

"If you can't drive with two hands, let me take the wheel."

"Do you drink?" said the exhibition manager to inquirer.

"That's my business."

"Have you any other business?"

Illuminating Thought

First Mechanic—"I wish I was built like a lamp post."

Second Mechanic—"For why?"

First Mechanic—"So I could lean against a cop when I was lit."

1920.	LECTURER	SUBJECT
Oct. 21st	Brig.-Gen. R. K. Bagnall-Wild	"Notes on the Inspection of Aircraft Steels"
Oct. 28th	L. Aitchison	"Aircraft Drop forgings."
Nov. 4th	W. A. Thain	"Case-hardened Steels and Some Defects met with During Inspection."
Nov. 11th	L. Aitchison	"Cold-worked Aircraft Structural Steels."
Nov. 18th	A. J. Rowledge	"Materials for Aircraft from the Point of View of the Designer."
Nov. 25th	A. A. Remington	"The Economical Use of Steel in Aircraft."

Fire in His Eye

Zeke—I ran all the way to the fire at the aviation field last night.

Reek—Did you save anything?

Zeke—Yeah; carfare.

(And now they scarcely speak.)

Interested Friend (to aeronautical writer)—Writing stories, eh? Why don't you try writing for the *Saturday Evening Post?*

Writer—The circulation is too big. I could never write two million copies of my story.

Keep your eye on the du Pont boom. It'l! be some Zeppelin before the convention gets down to business.—*The Hon. Ormsby McHarg.*

"Some Zeppelin" is an unfortunate metaphor. The name du Pont is synonymous with powder, and Zeppelins drop bombs on munition plants.

Pittsburgh, says Dr. Walther Riddle, is entitled to be known as the birthplace of aviation. Somebody should invent a Pittsburgmillionaeroplane.—*Life.*

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AERIAL AGE WEEKLY

12, No. 13 DECEMBER 6, 1920 10 CENTS A COPY

Airscape of the Well-known English Coast Resort—Southworth

The Pulitzer Race—A Remarkable Aeronautic Event

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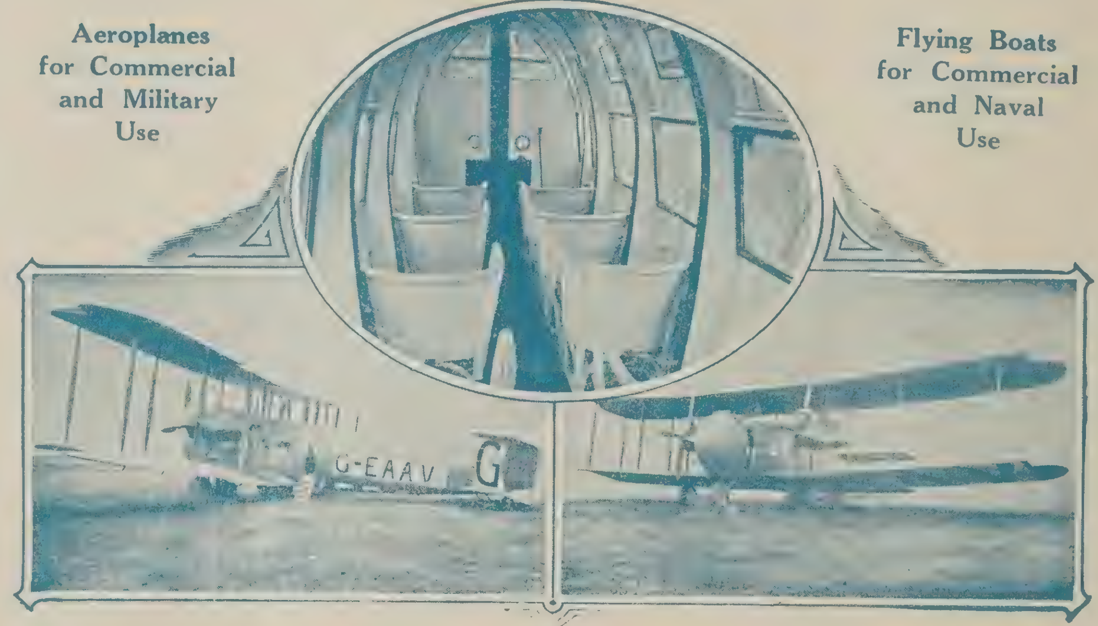

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VOL. XII NEW YORK, DECEMBER 6, 1920 NO. 13

THE PRESS ON THE PULITZER RACE

SOMETHING and a good deal of the discouragement that has been felt with respect to aviation in this country will be removed, partly by the brilliant achievements of the men who flew over the Long Island course for the Pulitzer trophy, and partly by the size of the crowd that devoted the holiday to watching the contest and the enthusiasm that was displayed.

That other nations for some years past have been giving, or seeming to give, more attention than we to the art and practice of aviation, its present great importance and its illimitable potentialities—that has been held, quite properly, something between a humiliation and a disgrace to America. But now it can be hoped that better times are coming—that the United States is to take its fitting place, at the front, if not in the lead, in an activity which started here and for a while existed nowhere else.

Nowhere are there better flyers than here or better opportunities for putting the aeroplane to practical use. All that is needed is public interest and appreciation such as exist in Europe.—New York *Times*.

CAPTAIN C. C. MOSLEY, in his Verville-Packard aeroplane, did not break the world's speed record, but he and certain other contestants for the Pulitzer Trophy showed that aviation is progressing steadily. Captain Mosley flew at a rate of 178 miles an hour. This is better than Sadi Lacointe's time in the recent Gordon Bennett race. It does not equal the 193 miles an hour done by De Romanet in France on November 4. The significance of the Mosley record lies in the fact that it was made over an extended course—132 miles—with pylons necessitating turns, while the De Romanet performance was for a mile over a straightaway course.

Tremendous speed is not the most important indication of aeronautical progress, but it is more significant than it seems. The development in the safety and reliability of aeroplanes has paralleled the increase in their velocity. The first Wright and Curtiss tractors made about thirty miles an hour and were reliable only under the most favorable conditions. At the beginning of the war exceptional machines could go at four times this rate, and they travelled with greater security. The conclusion of the war found the general serviceability of aircraft much increased, and speed stood at approximately 160 miles an hour. The gain of thirty-three miles which De Romanet's performance indicates has unquestionably been attended by further advance in general flying utility.

The relation between the two forms of progress is a simple one. The effort to go faster means in aeroplane design the cutting down of air resistance; an increase in the efficiency of lifting and propelling surfaces; an increase in motor power, or an advance in the adaptation of the engine to the aeroplane. It may, of course, mean all four, and in every instance any achievement meaning an increase in speed is likely to have a meaning for commercial flying. If one can fly 200 miles an hour with the same expenditure of fuel on which he once went 150 miles an hour, one has made an economical gain. If speed races develop better propellers or wing curves they usually pass on to air commence the ability to use heavier materials in construction or to carry heavier loads. And a machine flying at 200 miles an hour and consuming less fuel in proportion to motor power than one flying at half that speed can get across the Atlantic much easier. The Verville-Packard two years from now will be as reliable as an Army De Haviland. It will require but ten hours' gasoline to hop from Newfoundland to Ireland, where the Vicers-Vimy needed fuel, even with a strong wind "on its tail," for over sixteen hours.—New York *Globe*.

SPEED, however important, was not the vital feature in the race for the Pulitzer Trophy. Questions of national defense were brought to mind. The relations of aviation to the War and Navy Department organizations and the uses of aeroplanes in war were thrust on the attention of a great multitude.

The different types exhibited at Mitchel Field suggested the tactics of air warfare—the small scout, or skirmisher; the larger bombing and fighting plane, or the infantry; the heavy bombing and torpedo plane, or the artillery of the air.

One heavy plane was shown capable of carrying five 1,000-pound bombs. Consider the value of such a plane in attacking a fleet or a fort. The failure of the puny bombing attacks on the cruiser Goeben and the Turks at the Dardanelles cannot be cited against the efficiency of the present and the future planes. The bombs used there were small and many of them improvised. Modern bombs would undoubtedly have destroyed the defending ships and forts.

It was also demonstrated at the Dardanelles, as it had been repeatedly in former bombardments, that ships alone cannot reduce forts. But mortar fire—high-angle fire—is another matter; and bombing with charges of a ton of high explosive falling inside a fort has the effect of mortar fire. It is destructive where the fire of a ship's guns is comparatively harmless.

The recent air conference in London, attended by representatives of all branches of the British Government, decided unanimously that aviation should be so developed as to carry mails, freight and passengers in time of peace—that it should be made a paying business. And then in time of war the weight given to mails and passengers could be given to bombs and torpedoes—the planes and their pilots could be assimilated to the military forces as merchant ships long have been.

In the meantime what is the United States doing—anything or nothing?—New York *Tribune*.

THE NEWS OF THE WEEK

Hartford May Have Aircraft Station

Largely through the efforts of Lieut. Harry D. Copland, Hartford, Connecticut may in the near future, have a municipal aircraft station. The Finance Board has the matter under consideration and the majority of the members approve of the idea.

Pilot Copland has recently taken many of the important townsmen on surveying trips and a selection has been made among the various suitable places that have been mapped out from the air.

Aeroplane With Fifteen Flies South

An aeromarine cruiser, built for the Key West-Havana air mail and passenger service, flew southward November 21, carrying a crew of four and eleven passengers.

The big two motored "ship" took off at 8 A.M., from the waters of the Hudson in front of the Columbia Yacht Club at Eighty-sixth street. It was piloted by C. J. Zimmermann and carried Inglis M. Uppercu, president of the Detroit-Cadillac Motor Car Company; C. F. Redden, president of the Aeromarine Engineering and Sales Company; Herbert Tilt, president, and Earle Osborn, treasurer, of the Aeromarine West Indies Airways, Inc; Lieut.-Commander Davis, U. S. N., and several army officers.

The flying boat is named the Pinta. The two new in service between Havana and Key West are the Nina and the Santa Maria.

Cabot Re-elected Head of Aero Club of New England

The Aero Club of New England held its monthly meeting in the City Club, Boston, with Pres. Godfrey L. Cabot, presiding and about 30 members and guests attending. Rear Admiral Stanley S. Robison, cammandant at the Boston Navy Yard, and Maj. Gen. David C. Shanks, commander of the 1st Army Corps area, talked on development of aviation in the military and naval service. Parker H. Kemble, a director of the club, gave an illustrated talk.

The following officers were elected: Godfrey L. Cabot, president; Josiah S. Hathaway and J. Walter Flagg, vice-presidents; William Carroll Hill, secretary; Alfred R. Shrigley, treasurer; Godfrey L. Cabot, J. Walter Flagg, Charles J. Glidden, Josiah S. Hathaway, William Carroll Hill, Henry Howard, Alfred R. Shrigley, Nelson H. Smith, Carl E. Shumway, John J. Van Valkenburgh, Parker H. Kemble, Cyrus H. Stowell, directors.

Weather Station at McCook Field

A Signal Corps Meteorological station has been established at the Air Service Engineering School at McCook Field, Dayton, O., as one of a system of stations at military posts for the purpose of studying upper air currents and furnishing information concerning these currents to the artillery. Air Service and other branches of the military and civil services.

Newspaper Uses Aeroplane

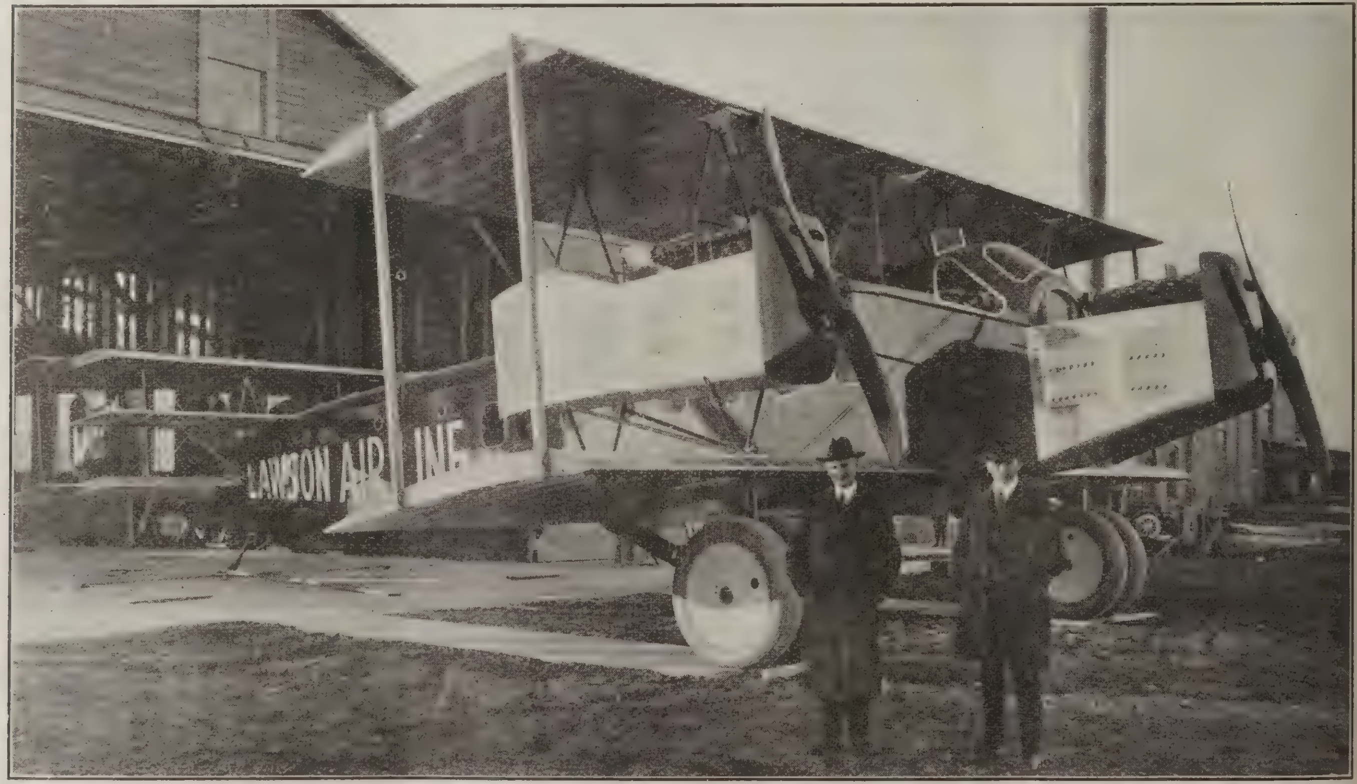
The Milwaukee *Sentinel* has been added to the list of newspapers using an aeroplane for special assignments.

After the recent accident on the Great Lakes when a Navy flying boat was lost in a storm, pilot Gilles Meisenheimer braved the element and took a reporter from the *Sentinel* over the Lakes in a search for the missing airmen. Great hardship was experienced by the men in the plane but it enabled the *Sentinel* to have a unique story on the accident and to perform what might have been a very valuable service.

Glidden Made Life Member of A. A. A.

At a meeting of the Executive Board of the American Automobile Association November 22, 1920, Major Charles J. Glidden's name was added to the list of life members and in connection therewith the usual fee was remitted.

Executive Chairman of the Association, Mr. A. G. Batchelder, in notifying Major Glidden of his election to life membership, says "It was the feeling of those present that you had been a most important factor in accelerating road travel and that your famous trophy had served a most useful purpose in connection therewith."



THE LAWSON MIDNIGHT AIRLINER

This is the first picture taken of the new Lawson Airliner No. 2, known as the "midnight airliner." This ship was designed by Alfred W. Lawson, the inventor of the first airliner and was built by the Lawson Airplane Company of Milwaukee, Wisconsin. This mammoth ship is the largest passenger carrying heavier than air aircraft in the world and was built especially for night service. The cabin is 65 feet long and the wing spread is 120 feet. It is powered by three Liberty motors aggregating 1200 horse-power. The speed of this ship is calculated to be from 120 to 125 miles an hour and it can fly at a height of 25,000 feet or over four miles high. This ship carries enough fuel for a 15 hour flight, therefore it can take the air in New York at about 10 o'clock at night and not come down to earth again until it reaches Chicago at 6 o'clock in the morning, without using all of its fuel. The man standing at the right is Alfred W. Lawson, who recently contracted with the United States Government to carry the United States mail to all of the important cities of the United States. He will use this type of machine for mail carrying as well as for passenger carrying and hopes to have a complete airline service in operation for this work by spring, although this ship within a few days will be put into the air as the first ship for this service and other ships will be added as quickly as they can be built

Verville-Packard Makes 186 Miles an Hour

Captain Corliss C. Mosley, in the Verville-Packard, brought the American speed record up to 186 miles an hour in a series of test flights at Mitchel Field, Mineola, L. I., November 27, but failed to establish a new world's record. In order to bring the coveted record to this country the plane will have to add another ten miles an hour to this speed.

Although the plane failed to realize the expectations of Army officials, the flights brought to light an interesting problem, which, when solved, may bring to this country premier speed honors of the world.

During each of the six tests made it was observed that upon the ground the powerful 600-horsepower engine was turning over at the rate of 1,950 revolutions a minute. The moment the battelplane took the air, however, the motor speed rapidly fell, until it was 200 revolutions a minute lower than the ground speed. Careful adjustment of the carburetor to overcome this condition at the end of each test failed to produce any different results.

Colonel J. G. Vincent, designer of the engine, who was watching the experiments, after careful examination expressed the opinion that the terrific speed resulted in a vacuum being caused at the back of the careburetor, which prevented that instrument from producing the proper gas mixture to insure the full power of the engine.

While the general design of the plane is very clean, the tests also showed that further stream-lining can be accomplished, particularly about the engine cowling and the windshield before the pilot's cockpit.

Immediately after the conclusion of the tests, it was announced that the battleplane would be shipped to the experimental air station at McCook Field, Dayton, Ohio. There the carburetor will be placed in the experimental wind tunnel and subjected to the approximate air conditions for a speed of 200 miles an hour. Careful observations will be made during this test in an effort to solve the mystery surrounding its performance in the recent flights.

When this has been done the plane will be sent over a measured course again for the purpose of winning for America the speed record of the world.

Fliers Reach Mexico City

Mexico City.—American aeroplanes of the Lincoln-Standard type arrived in Mexico City November 28, making the trip from El Paso to Mexico City through Chihuahua, Torreon, Monterey, Saltillo and Queretaro, 1,300 miles of actual flying.

The aviators received a rousing reception in every town. The War Department made preparations to receive the pilots and cadets of the aviation school were detailed to welcome the Americans.

New Records Are Set in Pacific Coast Flight

San Francisco.—Eddie Rickenbacker, American ace, flew from Los Angeles to San Francisco November 28 in 3 hours and 10 minutes, said to be a record for a northward flight over the 341 miles. He bucked a heavy wind all the way and made a forced landing at San José for gasoline.

A mark of 3 hours and 1 minute was set for the southward flight over the straight line distance November 27 by Lieutenant E. C. Batten, an Army flyer.

Thomas-Morse Scout Makes 171 Miles an Hour

Captain H. E. Hartney piloted the Thomas-Morse 300 H.P. scout over the one-kilometer course at Mitchel Field, Mineola, on November 28 in 13.02 seconds, or at the rate of 171½ miles an hour. The machine was built for a speed of 150 miles per hour, and Captain Hartney's feat is regarded as a remarkable testimonial to the American design and the efficiency of the Wright motor.

Air Race for California?

Los Angeles.—The next air race for the Pulitzer aeronautical trophy will be held in southern California, according to an interpretation of the rules governing that event by the officials of the Aero Club of Southern California, made public by George B. Harrison, secretary.

These rules, the officials stated, provide the race shall be held under the auspices of the club holding the trophy.

Mr. Harrison said the Aero Club of Southern California, whose entry, Lieutenant O. C. Moseley, won the trophy, hoped to stage the race here late next summer or early next fall.

Barr Flying Circus to Tour Japan

The Barr Flying Circus, of Los Angeles, comprising Pilots Monshower, Remlin and Sanders, who have been engaged in exhibition work for the last year, will leave San Francisco shortly for a tour of Japan.

Quick Work and a Record Flight

Lieutenant George W. Goddard made a record flight from Dayton, Ohio, to Washington, D. C., last week, covering the 400 miles in 3 hours and 20 minutes.

Lieutenant Goddard first flew to Dayton from Washington in a DH-4B, bucking the wind all the way and taking 5½ hours to make the distance. The purpose of the trip to Dayton was to have the DH-4B remodeled and converted into a photographic plane which will be used for mapping purposes around Washington.

Less than a week's time was consumed between the start from Washington, the remodeling of the plane at Dayton, and the return to Washington. On the return flight Lieutenant Goddard had the wind with him, and made the distance from Dayton to Moundsville, West Virginia, in 1 hour and 20 minutes, thence to Washington in 2 hours.

Floating Tests of DeH-4

A novel experiment was conducted by the engineering department at Luke Field, Hawaii, during the past week, which resulted in the partial settlement of a long dispute. With the ever-present possibility of landing in water with the land planes that are flown among these islands, and with the several instances where forced landings have been made in water, it was deemed advisable to run a test on a DeH-4 plane to determine just how long it would remain afloat. A salvaged plane was patched up and filled with water and gas, and weighed with two sandbags, one in each cockpit, and all conditions were met to simulate a plane having had an actual forced landing. The plane was then taken out in the bay and set afloat. There were many and varied opinions as to how long it would stay above the surface, and wagers were made accordingly. In the first forty-five minutes the plane sunk so rapidly as to leave but half the fuselage, part of the upper wing and the tail surfaces exposed above the water. This point, however, seemed to be the floating level and from then on it sank very slowly until at the end of two and one-half hours over half of the stabilizer and all of the rudder were still exposed. At the end of four hours the plane had drifted in shore and was grounded with the stabilizer submerged, but with the rudder still above the surface. Just how much longer it would have floated is still debatable, but the experiment was successful in showing that one could depend upon several hours afloat if a reasonably good landing were made in a comparatively smooth sea.

Unique Claim for Damages

The communication below reached the office of the Chief of Air Service in the regular routine of business. It is not, as might be supposed, a specimen of "free verse," but merely a plain, every-day, domestic claim for damages. The style is unique, and is recommended to all claimants for damages, who will find its brevity and "direct action" worthy of emulation.

> "Sirs one of the U. S. Flying
> ship No. 4217 landed in my
> cotton patch the day of 2 of O
> and it nock and blew out about
> 400 lbs of cotton and thrash
> out about a bushel of peas
> the man that was oprating the
> ship said I must send my damage
> in to the Governor he said
> something got the matter with
> it and He had to land in a
> large field where he could get
> back up
> So I would like for you to
> pay damage for same. We had
> envestigated it to be about
> $25.00 dollars damage at least.
> Yours ever

Canadian Notes

Air Vice-Marshal Sir Willoughby Gwatkin, Inspector-General of the Canadian Air Force, has returned from his recent trip to England, and has definitely assumed the duties of his office at headquarters in Ottawa.

Lt.-Col. Douglas G. Joy, C.A.F., recently established a speed record between Camp Borden and Toronto, when he flew the distance of 60 miles in fifteen minutes.

Montreal.—So close was the finish of the aeroplane races at the opening of the new air harbor and hangar of the Aerial League of the British Empire, at the Bois Franc road, St. Laurent, here, that only 30 seconds divided the two winning contestants. Aviator Brian Daville won on time, but disregarded the rules laid down for landing, while Adelard Raymond, who was beaten half a minute, followed the rules and was awarded first prize, this being the "Aerial League Trophy," a silver cup. Mr. Raymond, however, refused to accept the prize, claiming he had been beaten. After some discussion two trophies were awarded, one to the winner and one to the runner-up. Three Curtiss biplanes competed. Speed was calculated by the judges at 70 miles an hour.

Toronto.—Lieut. A. C. McLorie, pilot, and S. Bonnick, photographer, have returned, after a trip of two months through eastern Ontario. The flying tour was made in a "Canuck," a Toronto-built machine, and the flyers did over 4,200 miles, making hundreds of landings in all sorts of fields, but without a mishap. They took aerial views of all the cities, towns and important centers from Toronto to Montreal to Ottawa districts. Lieut. McLorie has accepted a contract from the Ontario government to carry out certain aerial surveys in northern Ontario.

The AIRCRAFT TRADE REVIEW

De Luxe Air Service Reorganized

The De Luxe Air Service which has been operating at Asbury Park, N. J. during the past season, has been reorganized and the personnel of the Company now is as follows: Charles D. Winters, of the Electric Service Company, President, Walter Steinbach, of Steinbach Company is Vice-President, Lt. H. A. Steiner, formerly of the 147th and 184th Squadron, is Secretary and Treasurer, and General Manager.

Among the other pilots are Lt. Frank Turner, former pilot, who was at Issdum as instructor during the war; Lt. Ted Parsons, former pilot of the 139th Aero Squadron, and Lt. Fred Lovenberg, former pilot of the 50th Aero Squadron; Lt. Verne E. Treat, former A. E. F. pilot.

The Company was organized in April and has flying fields at Komo and Deal, N. J., where gasoline and repair service is available for cross-country pilots. A substantial amount of passenger-carrying, aerial advertising and photography work has been done and the present plans of the Company would indicate that the activities of next year will be on a very large scale.

The Company maintains a large stock of Curtiss supplies, OX motors and parts, and pilots are assured of prompt attendance to their orders.

Aero Limited Service

Flying boats No. 7 and No. 8 of Aero Limited, piloted by Harry Rogers of Miami-New York record breaking fame, and Duke Schiller, left the base at Flushing Bay, L. I., Nov. 11, for Miami, Fla. The flight will be done in 17 hours.

In two weeks time Capt. Rogers will take plane No. 5 down on a non-stop flight. This will be the first time that a non-stop flight has been made between New York and Miami. It will be 1535 miles and will be one of the longest continous flights over water ever made.

Shortly afterwards Aero Limited's new fifteen-passenger twin-engine flying boat, piloted by Lieut. Alexander will leave for Miami. This will be known as the Amalgamated Flying Salesmen's Special. Ten representative firms of the North have engaged accommodations on this boat for their salesmen and merchandise. The boat will make stops at all of the principal cities on the Atlantic seaboard between New York and Miami. Arrangements have been made to have members of the Chambers of Commerce and leading merchants of these towns meet the salesmen and representatives on their arrival.

There have been previous flying salesmen's trips but they were individual and of short distances only. This will be the first time in the history of commercial aviation that an Amalgamated Flying Salesmen's Special has been attempted. The salesmen will report their sales back to their firms by wireless, the plans being equipped with a radio instrument and a competent operator in charge.

A certain number of private passengers will also be carried. Heretofore the rates between New York and Miami have been so high—in the neighborhood of eight hundred dollars—that the idea of flying down for purely personal reasons was prohibitive. At the reduced fare of two hundred and fifty dollars per passenger a full complement has been assured.

King Operates Plane Garage

Noted Aeroplane Mechanic Opens Aeroplane Service Station for Aerial Tourists in Western New York

All early aviators will remember Charles King, expert aviation mechanic and guardian of many noted pilots and ships from 1910 on. In the old days of exhibition work King was the assistant and mechanic of two well-known fliers, Lester Holt in 1911 and 1912 and Allen S. Adams in 1912 and 1913, both of whom lost their lives in government testing during the war. King was the first civilian mechanic to join the 1st Aero Squadron, N. Y. N. G., when it was organized at Mineola, L. I., under Captain Raynal C. Bolling, in 1916. Then John Hays Hammond's government experiments with wireless control of torpedoes from aeroplanes called and King responded and for the better part of a year he maintained the aeroplanes which were engaged in this work.

Always on the lookout for something new in aviation, King was one of the first mechanics to join up with the Air Mail Service. As chief mechanic at the Belmont Park terminus of the air mail lines, King was responsible for keeping the ships in commission and his contribution to the initial success of the service was a large one.

Commercial aviation next interested him, and we find him as chief mechanic of the Traymore Aerial Tours of the Traymore Hotel, Atlantic City, N. J., during the summer of 1919. Last winter King, Bob Shank and Bill Jenkins toured all the southern states with three planes carrying passengers, and introduced flying to numerous communities in Virginia, North Carolina, Georgia, Tennessee, Kentucky. Illinois and West Virginia.

King is now starting an "aeroplane garage," the first of its kind in western New York. He will deal in gas, oil, etc., repair ships, and overhaul engines—a real service station for the air tourist. His motto is "Drop in on us anytime—everybody welcome." Charles King is a super trouble shooter and maintenance expert and he deserves all the success which experience and exceptional ability usually bring.

Regular Air Mail Service to Cuba Now in Operation

Regular air mail service between the United States and Cuba is now being carried on as surely as regular transatlantic ship mail service.

Every day since November 1 huge Aeromarine-Navy cruisers, freighted with several hundred pounds of mail and ten or twelve passengers, have been running on schedule between Key West, Florida, and Havana, Cuba, crossing in an hour the gap which takes a steamer an entire night to bridge.

As a means of testing their stamina and reliability, the two Aeromarine cruisers were flown down the Atlantic coast from New York to Havana, a distance of 1,600 miles, just before the Key West-Havana mail service was inaugurated. The 1,600 miles were ticked off behind them as regularly as a watch marks off the second, although no effort was made to try for a speed record. But the Aeromarines, with their luxurious cabins and other fine passenger facilities, are not racing planes, but air yachts designed to carry passengers swiftly, yet in comfort.

According to reports reaching New York, the big air cruisers, named the Pinta and Santa Maria in honor of two of the caravels of Columbus, "hopped" to Norfolk, Virginia, on the first day of the journey and there permitted the score of passengers and the members of the crews to see something of the town.

Manteo, on the Island of Roanoke, where Virginia Dare, the first white child born in America, saw the sun, was the next stop, but it was not wholly because Virginia was born here that the big ships glided down to the water. It was near Manteo, on Kill Devil dunes, that the Wright brothers made the first flight in a motor-propelled plane.

Stops were also made on the southward tour at Southport, North Carolina, Georgetown, South Carolina, Charleston, South Carolina, St. Augustine, Florida, Port Pierce, Florida, and Miami, Florida.

The Aeromarines completed their first mail-carrying tour to Havana on November 1, which happened to be the Cuban election day, by alighting in Havana Harbor amid the cheers of a crowd which seemed to be the entire population of the city. Five hundred pounds of mail was delivered on the initial trip.

In discussing the success of these aerial cruisers, C. F. Redden, president of the Aeromarine Engineering & Sales Company, the concern who is placing these boats on the market, states: That due to the unusual interest in aerial transportation and the demand for these large cruisers and smaller boats carrying five passengers, they will have on the market soon a five-passenger enclosed cabin boat for aerial transportation.

Aerial Radiophone Entertains Delegates to Radio Commission

During the meeting of the International Radio Commission held in Washington recently, 150 of the delegates were given a demonstration of the newly-developed radio telephone operated from an aeroplane.

Secretary of War Baker, Secretary of Navy Daniels and other Cabinet officers entertained the members of the Commission with a trip on the *Mayflower* down the river to Norfolk, during which journey Captains Fraser Hale and Walter Lawson from Langley Field flew over the yacht, holding conversation from the plane with the party by radio. Just below Mount Vernon, ten De Haviland planes from the Tenth and Ninety-ninth Observation Squadrons joined the party, escorting the *Mayflower* in battle formation, Lieutenants Grissom Haynes and Frank Ames giving an exhibition of aerial acrobacy.

THE PULITZER RACE

SPEEDING through the air at the rate of almost three miles a minute, Lieutenant C. C. Mosley of the United States Army Air Service, piloting the Verville-Packard, won the first aerial contest for the Pulitzer Trophy at Mitchel Field, near Garden City, and gained for the Army the cherished honor of besting the Navy in the air. Handicapped by carburetor trouble which balked his efforts to demonstrate what this wonder plane of the Army could do, Lieutenant Mosley nevertheless flew over the course of slightly more than 132 miles in 44 minutes 29 57-100 seconds at an average speed of about 178 miles an hour.

Lieutenant Mosley was disappointed because he did not break the world's aviation speed record, made by Bernard de Romanet, who on November 4 in France flew at the rate of 193 miles an hour. The Verville-Packard was an entrant in the Gordon Bennett race but had to drop out because of a mechanical defect.

Captain H. E. Hartney of the Army, in a Thomas Morse plane, and Bert Acosta, a civilian contestant, in an Italian Ansaldo, captured second and third places, their time being 47 minutes and 51 minutes and 57 seconds, respectively. The two planes maintained an average speed of 168½ and 154 miles around the course. It was not until the fifth winner arrived that the Navy gained a place, and the loyal Navy contingent at the field told Lieutenant A. Laverents when he alighted from his Vought plane how grateful they were.

Aviation enthusiasts and Army and Navy flyers agreed that the race was the most successful aeronautical contest held in this country both from the standpoint of public interest and the number of foreign and American designs of aircraft entered. More than 25,000 people gathered at Mitchel Field, while several thousand more watched the race at Henry J. Damm Field, near Babylon, and Lufberry Field, at Wantagh, the turning points of the approximately forty-mile course over which the planes sped.

General John J. Pershing and Josephus Daniels, Secretary of the Navy, were interested spectators in the grandstand, and both declared that the race had afforded them a great deal of pleasure. Commodore L. E. O. Charlton, British Air Attaché, said that the meet had focused the attention of the American people on aviation and the recent development of aircraft. Contests of this kind fostered aviation and should be held frequently, he believed.

Brig. Gen. William T. Mitchel, chief of the aerial operations of the United States Army, said after the race:

"This race has been the greatest air race both in the number of contestants and the type of machines represented and the speed obtained. This marks the beginning of American supremacy in military aviation. We have the greater speed and by far the better pilots and the material and the means to develop military aviation."

The winners of the first ten places in the contest for the Pulitzer Trophy and the Valentine Liberty Bond prizes, aggregating $5,100, follow below. The Valentine prizes were awarded for the elapsed time winners with a particular type of aeroplane.

No.	Aeroplane.	Pilot	Time.
1	Verville (Am.)	Lieutenant C. C. Mosley, U. S. A	44:29
2	Thomas Morse (Am.)	Captain H. E. Hartney, U. S. A.	47:00
3	Ansaldo S. V. A. (Ital.)	Albert Acosta, civilian	51:57
4	Orenco (Am.)	Lieutenant St. Clair Street, U. S. A	52:27
5	Vought V. E. (Am.)	Lieutenant A. Laverents, U. S. N	55:39
6	De Haviland (Am.)	Lieutenant J. P. Roullot, U. S. A.	55:05
7	De Haviland (Am.)	Second Lieutenant Carl Eliason, U. S. A.	56:09
8	De Haviland (Am.)	Second Lieutenant J. B. Wright, U. S. A.	56:52
9	De Haviland (Am.)	Lieutenant C. M. Cummings, U. S. A	57:08
10	De Haviland (Am.)	Lieutenant D. L. Conly, U. S. N	57:40

VALENTINE PRIZES

De Haviland Class

No.	Pilot.	Time.
1	Lieutenant J. P. Roullot, U. S. A.	56:06
2	Second Lieutenant C. Eliason, U. S. A	56:09
3	Second Lieutenant J. B. Wright, U. S. A	56:57
4	Lieutenant C. M. Cummings, U. S. A.	57:08
5	Lieutenant D. L. Conly, U. S. A.	57:40
6	Captain H. N. Heisen, U. S. A.	58:15
7	Lieutenant V. C. Finch, U. S. N.	58:32
8	Second Lieutenant L. Claude, U. S. A.	59:56
9	Lieutenant W. R. Lawson, U.S.A.	60:48
10	Captain H. B. Mims, U. S. M. C.	60:49

VOUGHT CLASS

Lieutenant A. Laverents, U. S. N.	55:39
Lieutenant W. B. Gwyn, U. S. M. C.	59:59
Second Lieutenant L. H. Sanderson, U. S. N	60:09
Second Lieutenant W. V. Brown, U. S. M. C	61:35
Gy. Sergeant J. K. Dunn, U. S. M. C.	61:50

S E-5 CLASS

1	Captain M. Kirby, U. S. A	59:42

COMMITTEE INVITATION

1	Captain H. E. Hartney, U. S. A.	47:00
2	Lieutenant St. Clair Street, U. S. A.	52:27

From the viewpoint of the spectators the day was an ideal one for such an event. With the sun for most of the time concealed behind snow clouds, it was possible to watch the contest without suffering eye strain, and while the ground was muddy and covered here and there with pools of water, the "air fans" forgot any inconvenience once the race was under way.

Long before the race was scheduled to start long strings of automobiles began arriving at the field and parking at vantage points. Air Service officers in charge of the policing arrangements, which were excellent, estimated that nearly 5,000 cars were lined up at the three fields at Garden City. Beginning at 10:15 thousands of men and women began pouring into the fields from special trains which the Long

The Verville-Packard 600 H.P. biplane which won the Pulitzer Trophy Race. In the insert is Brig. General William Mitchell congratulating the pilot, Lieut. C. C. Moseley

Island Railroad ran as far as the Government reservation.

Prominent Army and Navy officials and guests of the Aero Club of America, under whose auspices the contest was conducted, were admitted to a specially built grandstand in front of a score board which, unfortunately, was not large enough to be read by the majority of the spectators.

As the last of the contesting planes was arriving at the starting line a slight accident eliminated two, an Army and a Navy plane. The two, an Orenco piloted by Lieutenant O. G. Kelly, U. S. A., and a Loening, piloted by Lieutenant J. S. Wolfer of the Navy, collided as they were taxi-ing up the field. Both machines were badly damaged. Lieutenant Kelly had three of his teeth knocked out, but the Navy pilot escaped injury. That this slight accident was the only one which occurred during the meet was attributable in no small measure to the Army and Navy discipline maintained at the fields.

The first plane to "hop off" was a Thomas Morse scout piloted by Captain Hartney, which left the ground at 11:20. This plane, which finished second, was the same machine which broke the world's speed record of 168 miles an hour at Ithaca, New York, last January. A Loening Special, piloted by Lieutenant B. G. Bradley of the Marine Corps, got away second and was followed by the other machines listed in Flight 1. In rapid succession the other contestants were given the signal to "take off" and by the time the last of the thirty-four machines had encircled the field the spectators were watching the approach of the first plane to fly around the circuit.

The interest of the spectators seemed to center in the much-heralded Verville-Packard, which has been undergoing secret tests during which remarkable records were made, according to Air Service officials. This machine was the last to start. A cheer went up as the dark gray machine with lightning-like speed mounted into the air, its course being marked by a stream of smoke several hundred feet in length. For a few minutes it was lost in the haze and then the powerful craft swooped again into view, crossed over the starting line headed for the Henry J. Damm Field.

General John J. Pershing and Secretary of the Navy Daniels were interested spectators at the Pulitzer Race

The public also seemed interested in two Curtiss-Kirkham triplanes, a type seldom seen in this country. Lieutenant W. D. Culbertson of the Marine Corps piloted one and Lieutenant C. W. B. Haviland the other.

From the start to the finish the air was vibrant with the hum of motors as the machines sped around and around the pylons. Before the spectators believed it possible the Verville-Packard was seen returning from the east ready to fly away on the second lap. It covered the circuit in 11 minutes 6 and 71-100 seconds.

Regret was expressed when Lieutenant Bradley in the Loening Special was compelled to land on the fourth lap within a mile from the starting point. He was traveling at the rate of 161 miles an hour and appeared certain to finish among the leading winners.

Twelve of the contestants came to grief during the race, eleven on account of mechanical trouble, while one was disqualified for an infraction of the regulations. When Lieutenant Mosley brought his victorious machine to a stop, the immense crowd broke past the guards and crowded around him. It was with difficulty that the guards forced the spectators to a realization of their danger from other machines which were landing on the fields and forced them back of the ropes.

General Mitchel was the first to congratulate the victor, who modestly fended off others who sought to shake his hand by disappearing on the arms of two young ladies whose automobile soon placed him at a distance from the field.

The Contest Committee was composed of the following men:

Benjamin F. Castle, Chairman
Caleb S. Bragg
H. S. Brown
Douglas Campbell
Maurice G. Cleary
W. Redmond Cross
Harry Guggenheim
Richard F. Hoyt
Alan R. Hawley
Albert B. Lambert
William A. Larned
David McCulloch
Edward O. McDonnel
Charles E. Merrill
George M. Myers
Howard A. Scholle

Few of the spectators left until the last contestant had finished, when there was a general scamper for the special trains which brought them back to the city.

The Aero Club of America, under whose auspices the race was run, officially notified the Aero Club of Southern California that its representative, Captain Mosley, had won the race. The trophy was formally presented to Captain Mosley at a dinner given for him by Grover C. Loening, aeronautical engineer, in the New York Yacht Club.

Those at the dinner included Major-General Charles T. Menoher, chief of Air Service, U. S. A.; Brig.-Gen. Mitchel, chief of operations of the Air Service; Captain T. T. Craven, director of naval aviation; William C. Potter, Ralph Pulitzer, donor of the trophy; Colonel Thurman H. Bane, chief of engineering division, U. S. Air Service; Captain Hartney, Lieutenant St. Clair Street, Lieutenant B. G. Bradley, U. S. M. C.; Major A. M. Christie, Henry M. Crane, J. G. Vincent, George H. Houston, president of the Wright Aeronautical Corporation; Caleb S. Bragg, David H. McCulloch, Edward McDonnell, Maurice G. Cleary, Walter P. Jacob, and A. P. Loening.

THE ORGANIZATION OF CIVIL AVIATION ALONG INTERNATIONAL LINES

By WILLIAM KNIGHT, M.E.

Technical Assistant in Europe of the National Advisory Committee for Aeronautics

THE progress made by aviation within the last few years is probably the biggest and most important actual result brought about by the war. Aviation which, when the war broke out, was yet more or less in the experimental stage, has been developed to such an extent during the war as to become one of the most important weapons used by both sides, and I think it is safe to predict that if other wars should be fought in the future the nation or the group of nations possessing the best control of the air would win in the end. But aside from any consideration of a purely military nature, the development of aviation along commercial lines is bound to be a tremendous factor in promoting trade by providing a rapid means of conveyance of passengers, mail and freight between important commercial centers and in opening up new lines of communication which could not be conveniently established with our present means of conveyance.

It is quite evident that in order to bring about the most efficient results, commercial aviation must be established and developed with a view of satisfying not only local requirements as affecting each single nation but also, and most important, with a view of tying together with international aerial routes all nations around the world.

The wonderful progress made in aeronautics during the war was certainly due to the unlimited financial means put at the disposal of research workers, designers and aircraft manufacturers, but also and foremost to the spirit of mutual cooperation prevailing at that time between the nations entering the two opposite belligerent groups which led to the adoption by all of certain types of machines to the abandonment of other types, to the establishment of rules and regulations common to all, to the cooperative study of the various theoretical and practical problems as affecting the design, the construction and operation of the aeroplane.

Now that the war is over, we find aviation in all countries facing a crisis. The aeroplane was born and developed as a fighting machine at a time when no consideration of cost entered into the design and the operation of it and when the security in flight had only as much importance as it could possibly be given to it in war time. Under the present peacetime conditions we find that the aeroplane, such as it is, is inadequate to the requirements of civil aviation. The resulting organization governing the air service during the war cannot be applied to serve civil aviation needs and we need instead laws and regulations to govern the air navigation, both national and international. Aircraft manufacturers that during the war have been accustomed to large profits, and to receive all possible assistance on the part of the various governments in the way of free advices from all sorts of experts and research agencies, find themselves now without orders, without a civil aviation program to lay out their plans accordingly, with little encouragement on the part of the governments to keep on with their work and they just simply do not know what to do Under these conditions aviation is now at a standstill and whatever efforts are made by individual firms and organizations in order to promote civil aviation are accomplished with limited views and limited means which can only produce limited results.

The great need of this moment is organization and cooperation. If we want commercial aviation to become a powerful, economical factor, we must arrange it on a large scale and start establishing first, international aerial routes providing a rapid, sure and efficient means of communication over long distances. Any attempt to establish civil aviation with a view of serving the needs of one single country only with the exception perhaps of large countries such as the United States and Russia, cannot be a successful business enterprise because the aeroplane at the present stage of development cannot compete with the railroad over short distances, especially the present all-wood aeroplanes.

We need cooperation on the part of the various governments in passing laws governing the air navigation, in granting facilities for the establishment of aerodromes where needed, in utilizing commercial aviation for carrying mail, etc. We need cooperation on the part of research organizations in solving the many problems involved in flight. We need cooperation on the part of aircraft manufacturers for producing efficient types of commercial machines such as they have not yet produced.

All this can be accomplished in a comparatively short time, but if commercial aviation is to be established along international lines and be a good business enterprise, we must not leave it to each nation to work out the problem from within. What is needed is a powerful organization that will approach the problem from an international point of view, that will establish and operate aerial lines of communication, tying together the most important commercial centers of the world, that will take the initiative in framing up the legislation needed for governing the navigation of the air, that will be able to give a program to the aircraft manufacturers in the United States and in Europe to work on. This could be the structure, the foundation of commercial aviation which would start operating along international lines and would be the pattern on which commercial aviation could be established in each country for serving the particular needs of the various countries in the world and operating in connection with the international air routes.

I do not see why this scheme should not appeal to the American capital and American ingenuity. We have all that is required to be successful in such an enterprise. Why should we not do it and make it pay?

An organization of this nature, as I see it, requires a good deal of flexibility in order to be efficient. Three distinctive branches of activities are required in such an organization: One branch needs to be concerned with real estate problems such as buying, leasing or otherwise obtaining the necessary grounds at points of arrival and departure of the aerial expresses, construction of hangars, warehouses, workshops, terminal stations, office buildings, subsidiary railway lines, etc. A second branch will have to deal with the production of aeroplanes, motors and equipment. The third branch will have to take care of the operation of the aerial lines. Each of these three branches could be organized as a separate corporation, all three being controlled by the same financial group. Such an arrangement would offer the advantage of possessing the required flexibility for the successful operation of the whole organization and would make it more easy to find the money needed.

The first corporation, which would be a building and constructing corporation, should not necessarily need to confine itself to the type of buildings and constructions required for the establishment and operation of international aerial routes but could also find a large field of activities in the war-devastated regions of Europe.

The second corporation should be distinctly a corporation of aircraft manufacturers and should take care of designing, experimenting and construction. Aircraft manufacturers in the United States and Europe could be easily induced to enter into such a combination which would supply the aeroplanes, dirigibles, engines, spare parts and equipment required, according to specifications. They would get the benefit of the research work and expert advices supplied by the corporation and besides working at the standard types required by the organization they could take care of the construction of other types of aircraft for military uses, for local aerial commercial lines, for sports, etc. Furthermore, aircraft manufacturers that since the armistice have gradually changed their production partially or totally to a variety of woodwork and metallic construction, could easily supply a large share of miscellaneous finished products to the building and construction corporation.

The third corporation should take care of the establishment and exploitation of aerial lines and subsidiary services such as mail service, telegraphs, telephones, signalling stations, emergency repair shops, etc. This, of course, would be the main corporation, the other two being more or less under the control of this last one. All plans and specifications as to types needed should be drawn up by this corporation, the realization of these plans being left to the other two corporations.

The money needed for such an undertaking could be subscribed in the United States and in Europe provided, however, that the controlling interest be retained by the American capital.

In connection with this scheme for establishing and developing main aeronautical lines in the United States and all over Europe, it is necessary to point out the enormous benefits that could be derived by establishing and developing commercial aviation in Russia. When we consider the large land extension of that country, the rudimentary state of railways, the great distances separating important commercial centers and the enormous commercial opportunities to be found in Russia, we can easily realize how important it would be to establish and operate aerial lines such as Petrograd-Moscow-Kieff-Odessa-Italta, or Petrograd-Moscow-Kharkoff-Wladikovkaz, covering these distances in twenty-four hours. The trip Moscow-Tokio or Moscow-Pekin, two trans-Siberian lines, could be made in three days. The international lines: Paris-Moscow, in twenty-four hours; Berlin-Vorsovie-Moscow, in ten hours; Odessa-Bukarest, in three hours; Petrograd-Stockholm, in five hours; Petrograd-Copenhagen, in nine hours; Odessa-Constantinople, in four hours; Odessa-Vienna, in six hours; London-Calcutta, passing through Tarnopol, Astrakhan, in three days, are of such importance that I do not need to emphasize.

It is well to point out that the tremendous bearing that the development of civil aviation is bound to have on the economical life in Russia is fully realized in that country and in other European countries. France, which is more interested than any other nation in the re-establishment of Russian credit, has been probably the first to realize the importance of commercial aviation in Russia.

In the summer of last year negotiations were started between the Denikine government, the Russe-Asiatic Bank and a group of French aircraft manufacturers for the establishment of aerial lines in the Donetz Basin for the transportation of mail and freight, the Denikine government guaranteeing a minimum load for each trip. The proposals advanced by the Russians were: First, the French aircraft manufacturers were to supply the flying materials needed, aeroplanes, equipment and spare parts; a company would be started for the exploitation of the aerial lines and French aircraft manufacturers would become stockholders in this company to the extent of the sale price of the material furnished, the balance of the capital needed being subscribed by the Russian-Asiatic Bank. The dividends of such business enterprise being paid to French aircraft manufacturers in gasoline for an equivalent value. These conditions were accepted by the aircraft manufacturers with the exception that they asked that half the price of the material supplied by them be paid in francs so as to become stockholders in that company to the extent of one-half only of the sale price of their materials. The payment of dividends in gasoline was accepted.

These negotiations could not be brought to a conclusion on account of the downfall of the Denikine government, but the points agreed upon show at least that French aircraft manufacturers were willing to risk their benefits in such an enterprise.

In conclusion, an important field of activities is open to us if we will size up the opportunity which offers itself to us at this particular moment for creating a good-paying business, which will at the same time insure to our country the leadership in the dominion of the air.

THE WRAGG ADJUSTABLE COMPOUND AEROFOIL

By C. A. WRAGG, A. E.

An adjustable combined aerofoil has been invented for the purpose of enabling wider speed-variation to be obtained than has hitherto been possible because of unavoidable aerodynamic and constructional difficulties. It consists of using two aerofoils suitable for very high speed and placing them at a low incidence, one behind and a little below the other so that there is a small gap between them. The rear main spar, which is situated at about the c. p. of the rear section, is integral with the spars of the forward aerofoil, being connected thereto by compression webs or by any of various forms of truss, and provision is made for adjusting the angle of the rear aerofoil by tilting the leading edge upward in conjunction with a descending movement of the trailing portion of the forward one so that the two aerofoils are joined together; they then meet the air as a single unit surface of large normal angle and camber. Fig. 1 illustrates the combined aerofoil in position for high-speed flying, adapted to a biplane type by a suggested form of truss. Fig. 2 shows the system in position for landing, and it can be readily seen that the camber as a whole can be made as large as desired in the layout of the machine and varied by a simple adjustment in angle of unit portions of the system. Incidentally, these two figures illustrate two different suggested forms of truss.

The intention is, of course, to produce an aerofoil system having less drag when flying, with lift coefficients suitable for high speed, and yet one which has a high coefficient when changed to the position for landing. If the drag coefficient of the deeply curved position is high it would be to advantage for landing purposes in confined spaces. Wind tunnel tests indicate that the scheme is a very desirable and feasible method of solving the problem of landing very high speed aeroplanes, offering less constructional difficulty than anything yet suggested which would give the same efficiency and ease of control with positive operation. Some strong features about the device are that the wing bracing is rigid at all times, not being in any way interfered with by the mechanical changes during flight. The operation is positive and under perfect control of the pilot. The rear aerofoil is balanced, and the fact that the c. p. moves forward as the angle is increased and offsets the increasing pressure on the adjustable portion of the forward aerofoil, means that very little power would be required to operate the system even in extremely large machines.

A modified form of the device is provided for by the inventor to enable the area to be varied in conjunction with the angle and camber by adapting the aileron portion of the forward aerofoil to slide into the interior and thus be out of contact with the air when flying at high speed.

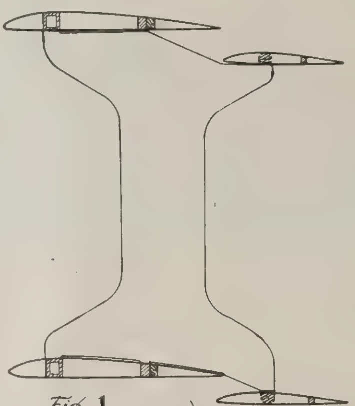


Fig 1.

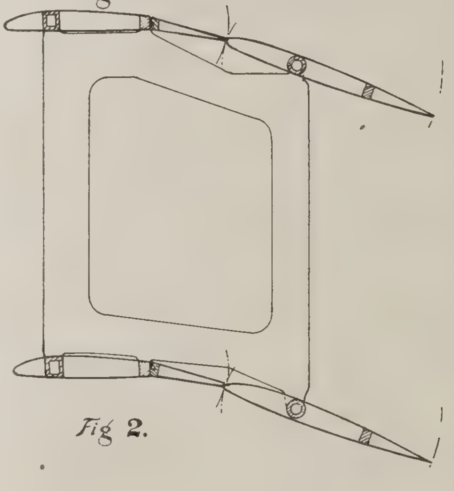


Fig 2.

The device makes it possible to embody larger area in a wing-unit even while using higher aspect ratio, for the high-speed position, than the present day standard aspect ratio. Another very important advantage is that the aeroplane body would not have to be subjected to the objectionable tilting, which should not be excessive in commercial and passenger machines, and which is quite unavoidable in landing with a fixed-wing plane.

The inventor claims that the airflow about the system, when the proper individual sections are used, is such as to reduce the drag at high speeds, making possible higher speed for a given power. This is caused by the mutual reaction of such aerofoils when placed in the position specified. The airflow in front of an aerofoil has an upward trend, and when it strikes the surfaces its relative velocity is reduced and the pressure is lowered in the wake; the result is that the drag on the rear one is lessened and the lift on the forward one is improved, beyond their values when used separately. It is stated that certain undesirable conditions of airflow as such are reduced or eliminated by the proper combination, and some other desirable conditions created and utilized; the higher aspect ratio used assists these general conditions, and also the higher speed now demanded for commercial purposes. He also says that the system of airflow is broken down if the individual aerofoils used are concave to any great extent on the under surface, and not only are the advantages lost, but very undesirable conditions are introduced. This is the reason why previous attempts to group aerofoils have not been successful. There are many suitable aerofoil sections in existence, although a research would probably disclose that there are particular types which would make greatest use of the advantages of the device, but any data already in existence which could be construed to indicate inefficiency is not a criterion because it was not obtained on suitable sections placed in correct relation to each other.

The use of sections having different lift coefficients at the same angle, or set with a slight dihedral between their relative angles in the system, would introduce an inherent stabilizing factor and enable higher speed to be obtained than is possible at present by enabling flying to be done safely at angles nearer to the zero line.

FAILURE OF CASEIN GLUE JOINTS IN ASH

By LOUIS J. BRADFORD

Assistant Professor of Machine Design, The Pennsylvania State College

Casein glue possesses many admirable qualities which have led to its use in many fields where a strong, water resistant adhesive has been desired. When applied to soft woods such as pine or spruce, excellent results have been obtained, provided the proper proportions of glue and water have been used, and proper methods of mixing employed. When applied to hard woods such as ash and oak, however, serious difficulties have been encountered.

One factory using considerable quantities of this glue for glueing ash parts found that joints which were apparently perfect when they left the glue room would open before all the manufacturing operation to be performed on the parts had been completed. Sometimes a joint four or five inches wide and several feet long, when once started with a chisel, could be separated entirely by the fingers. In most cases the failure appeared first as a minute crack near the end of the piece. This crack rapidly extended until it became so serious a defect that the part had to be rejected. In most cases considerable forming work had been done on the part and this waste of labor added greatly to the loss incurred.

Inquiry among other factories doing similar work revealed that they were experiencing the same difficulty, some of the firms reporting that they had been obliged to abandon the use of casein glue for joining ash and oak and return to the use of hide glue for this work.

These failures led to many tests being made to determine whether the glue was at fault or whether it was merely unsuited for use in connection with ash and oak. The procedure followed in the testing laboratory for a certain large factory was to glue together two carefully selected pieces of wood approximately thirty inches long, and then cut shear blocks from them after they had aged the desired length of time, usually six days.

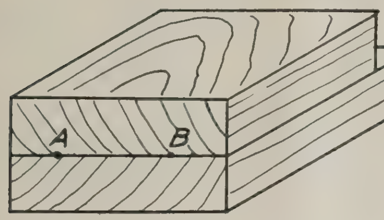


Fig 1

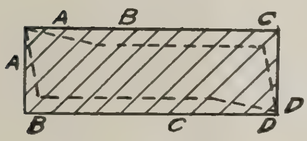


Fig. 2.

Shape after shrinking shown dotted.

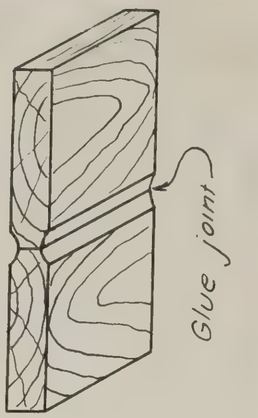


Fig. 4.

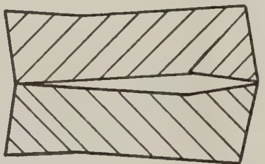


Fig. 3.

These blocks were usually tested immediately after being cut.

On one occasion some hours elapsed between the cutting and testing of the blocks, and it was noticed that the joints in several specimens had opened between the points A and B in Fig. 1. The fact that the joint was perfect when the blocks were cut led to the suspicion that the failure was caused by shrinking of the wood. Other sticks which had been glued up but not cut were examined, and in several cases the joints were found to have opened at the ends of the sticks, although a few inches back from the ends the joints were still perfect. The checked portions were cut off and the freshly cut ends of the remaining portions shellacked. It was found that no further checking took place. This seemed to confirm the theory that the checking of the joints was due to shrinking or swelling of the wood.

If a block with the annual rings making an angle of about 45° with the surface is jointed so that the surface is flat, as shown in Fig. 2, and then dried it will attend to assume a cross sectional shape, as shown by the dotted lines. This is because the shrinkage is far greater in a tangential than in a radial direction, and also because the tangential shrinkage is directly proportional to the length of annual ring. Thus the shrinkage along the annual ring "A," Fig. 2, will be small because the length of this ring is small. As we move to the right from "A" in Fig. 2 the shrinkage in each successive ring increases until ring "B" is reached. All the rings in the block from "B" to "C" are the same length and the shrinkage between these points will therefore remain constant. From "C" to "D" each successive ring is shorter than the one preceding it, and the shrinkage is correspondingly reduced.

If two such blocks of wood are glued together they will, on drying, tend to assume the shape shown by the dotted lines in Fig. 3. This tendency to "cup" will be resisted by the glue, which will be subjected to a tensile stress at any point sufficient to distort the wood to an amount equal to the shrinkage at that point. This tensile stress in the glue joint will be greatest at the point where the first full-length rings come into contact. If the wood is sufficiently strong and the shrinkage sufficiently great the joint will open

(*Concluded on page* 354)

THE LAMBLIN RADIATOR

THE Lamblin radiators have been produced specially with a view to low weight and head resistance. They include films of water arranged radially around an axis parallel to the direction of motion of the aeroplane. These films of water are contained by very thin boxes of copper, in the interior of which the water circulates. These boxes are connected at the outside to two collectors, which carry the bearers, permitting the installation of the radiators on the aeroplane.

These radiators weigh, empty, including the tubes and attachments, from 17 kilograms to 50 kilograms, with head resistance of from 272 to 724 grams a second. The total radiating surface for these radiators ranges from 7 to 19 square meters, the surface on each square decimeter being from .92 to 1 square meter (that is, the ratio of radiating surface to projected area is between 92 and 100 to 1). The water contains from 4.5 to 17.7 liters.

The use of supercharged engines and of high-powered engines impresses anew the problem of oil cooling. The Lamblin radiators for oil are fixed on the wall of the fuselage, horizontally or vertically, and have exposed only the cooling elements, the oil tank and the pipes being completely housed inside the fuselage. The radiator is composed of a reservoir and tubes contained within films of oil, the whole being of nickel-plated aluminum.

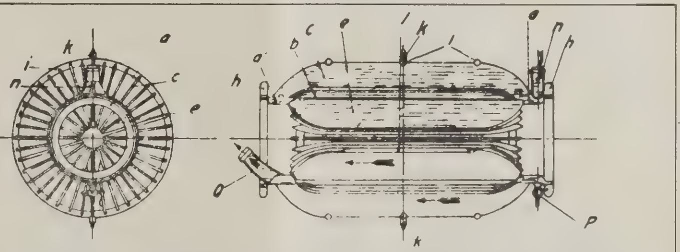


Fig. 1 Radiator Lamblin - (a),(a'),collectors - (b),collector tube.-(c),(e), cooling coils for the water circulation.- (i),tube joining the outside elements (c):-(k),upper and lower stops of the middle tube(i), which serves for the exhaust for air and water.- (g)(h),arrangement for fixing the radiator to the airplane.- (n),water inlet.-(Q),water outlet.

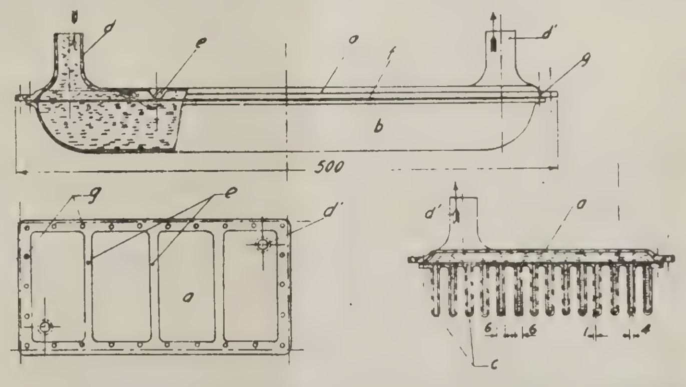


Fig. 2 Aluminum, oil radiator Lamblin.-In the upper part. longitudinal view; in left and lower part: plan view of the block collector; on the lower right-hand part. lateral section.- (a) oil reservoir.-(b) oil block radiator, (d) oil entrance.- (e) lateral ribs forcing the oil to circulate in the cooling coils- (f), (g), joints connecting the two parts of the radiator.

THE GERMAN AIRCRAFT INDUSTRY

By EDWARD P. WARNER

THIS report was prepared for the National Advisory Committee for Aeronautics by Prof. Edward P. Warner, the Committee's Acting Technical Assistant in Europe, and describes the aircraft factories of the Junkers and Zeppelin Airship Companies.

The aircraft industry in Germany has almost ceased to exist, so far as construction is concerned, new building being forbidden under the terms of the treaty. A good deal of building of new aeroplanes and remodelling of military machines for commercial purposes, however, went on between the time of the armistice and the going into effect of the stipulations of the treaty, and the machines produced at that time are now being used to some extent. Although a number of Aeroplane Transport Companies are doing business regularly, the Zeppelin line has been discontinued. This line operated the Nordstern, and also the Bodensee, which has been redesigned to carry more passengers. A single agency in Berlin is booking passages by eight different lines,—Albatross, Junkers, Rumpler, Sablatnig, Hawa, Balug, Dansk Luft Ekspres, and Wiener Fluggesellschaft,—and regular trips have been made from Bremen as a center to Berlin, Hamburg, Wangeroog, Norderney, Borkum, and Sylt, as well as between Berlin and Warnemunde and Berlin and Leipzig. The fares are moderate, the charge from Berlin to Leipzig during the Leipzig festivals having been only 800 marks ($16.00 for about 125 miles).

The only aircraft factories that I visited during my brief stay in Germany were those of the Junkers and the Zeppelin Airship Companies. A number of the other builders, although unable to do anything at the present time, are reported to be carrying on experiments on aircraft elements and keeping their shops in shape to start work again as soon as the ban is lifted, this being especially true of the subsidiary Zeppelin Companies at Seemoos (Dornier) and at Staaken (Rohrbach) and of the Rumpler and D. F. W.

The Junkers Factory

The works of the Junkers Company are located at Dessau, about a mile to the south of the center of the city, the main factory where the engines are made, and the aeroplane factory being about a quarter of a mile apart. The aeroplane factory, which includes also the wind tunnel and part of the general laboratory equipment, is a one-story building having about 25,000 sq. ft. of floor space. Twenty aeroplanes were in course of erection at the time of my visit, and I should estimate that there are 250 men employed on aeroplane construction. The machine tools are being worked up to their capacity and the whole plant has an air of intensive and efficient effort which is not common in Continental Europe at the present time.

The Junkers firm is making at the present time only one type, the six-passenger all-metal monoplane so well known in America. The construction and alignment of the parts of these machines is taken care of by jigs instead of by individual fitting, thus assuring complete interchangeability. The wings, for example, are mounted on a jig representing the side of the fuselage with its fittings, a method which, while not at all rare, is not so universally applied as would be desirable and which is peculiarly easy to apply with an internally-braced aeroplane, where all of the attachments and bracing are in a single unit and bear a definite relation to each other.

The corrugated duralumin covering for the wings is said to be 0.3 mm. in thickness, which is somewhat less than the thickness of the covering on the Junkers broken up at Mineola and examined by the Air Service. The spar tubes are about 60 mm. in diameter and the walls of the different tubes vary from 1 to 2 mm. in thickness. Up to the present time it has been found impracticable to use a larger diameter than 60 mm. or a less wall thickness than 1 mm. in conjunction with that diameter, on account of the danger of local collapse of the wall. Each wing is fixed to the fuselage by nine screwed attachments, and the wings can be removed entire or replaced in fifteen minutes. The fittings are made of 60,000 lb. carbon steel.

The Junkers firm has a well-equipped testing laboratory for materials, but they are doing nothing themselves on the development of alloys, using the laboratory to check up on the suitability of the materials delivered to them. They say that the duralumin which they can obtain has considerably deteriorated in its weathering properties within the last few years, and that it is now essential to paint all exposed duralumin surfaces for protection, whereas a few years ago the duralumin which they were obtaining could be exposed for years without any protective coating and without any important deterioration. The welding of duralumin thin sections is reported to be absolutely hopeless, no heat treatment restoring the original properties. In any case, it is necessary to heat-treat after rolling the sections. The Junkers people claim to have very little confidence in steel construction for aeroplanes of small or moderate size. Although their first all-metal machine, a single-seater, was built entirely of steel and iron, they found it excessively heavy and apparently have no intention of returning to that method.

Seaplanes of a type practically identical with the land machine, except for the addition of floats, are also being built. The floats are all duralumin, with flat bottoms and parallel sides and a single step and three bulkheads dividing each float into four water-tight compartments, and the method of frame construction employs a combination of tubes and rolled sections in much the same manner as does the wing.

Aside from the wind tunnel, which has been described in another report, there is nothing very new about the Junkers laboratory. The director tells me that they find impact testing of metallic materials very useful, and it would certainly appear, in view of its extended employment everywhere else in the world, that this method should find a wider application in America than it has done as yet.

The Zeppelin Factory

The Zeppelin Airship Company's factory is located on the outskirts of Friedrichshafen. The equipment comprises two or three good-sized factory buildings, the new laboratory, two airship sheds, and a flying field. At the present time no construction is going on, the men who have been retained being engaged in clearing up old stock and in making other aluminum goods than airships, but the managers of the company are all set to go the minute that new construction of the operation of an airship transportation line on a large enough scale to be worth their while is permitted, and they are seeking orders in all directions. I have seen no other firm anywhere in Europe so optimistic about the immediate prospects of aerial transportation and their own share therein. At present the company employs two hundred men, a reduction from four thousand during the war.

The airship sheds are now occupied by the Nordstern and the Bodensee, without their gasbags in place. The Nordstern has never been inflated.

The Zeppelin people speak with some disdain of the making of elaborate stress calculations for rigids. They say that this may be all right at first, but that the stresses are too complex and uncertain for such treatment and that design must ultimately depend on empirical rules and on the result of accumulated experience, and they lay great emphasis on their own favorable position in respect of such experience by comparison with anyone starting anew. Airship building, of course, is unlike aeroplane work in that practically nothing has been written on it. What the Zeppelin company have learned is their secret, and the British had to start again from the ground, and had to depend much more on fundamental theory than the Germans had ever done, as they (the British) were trying to begin their work far up on the ladder of progress, invoking mathematical analysis to enable them to omit many of the rungs by which the Germans had climbed. The Germans attribute the success of their ships in large part, too, to the skill of the workmen whom they have trained, claiming that no other nation or company has fabricated such light aluminum sections with the same success. London, September, 1920.

Spokane News

Spokane, Wash.—The newest development in aviation in the Spokane territory is a plan to establish commercial flying between Spokane and Seattle. The United States Aircraft corporation, which operates a $100,000 plant here now, is behind the plan. It expects to use rebuilt DeHaviland machines equipped with 400-horsepower Liberty motors. Each plane will have a carrying capacity of six or more passengers. The company has 14 pupils enrolled at its aviation school, one being a Japanese entered by the government of Japan.

Touching on other branches of aerial activity C. H. Messer, president of United States Aircraft, said:

"We intend to develop aerial photography. We will make trips over the national parks, taking moving pictures while flying. Release will be made through the Pathé weekly news service. Arrangements for this have already been made. A service of photographing cities or making views of any commercial concern's place, or picturing tracts of land will be available."

Air Pilots Mamer and Tattersfield, of Spokane, recently made rather an unusual trip to Eureka, Montana. In flying over the Cabinet range of mountains they reached an altitude of 12,000 feet and safely weathered two hailstorms and a snowstorm.

NAVAL and MILITARY AERONAUTICS

Aviators' Certificates

The following excerpts from the Rules and Regulations of the International Aeronautic Federation governing the issuing of pilots' certificates will be interesting:

1. Candidates must accomplish the three following tests, each being a separate flight:

A and B—Two distance flights consisting of at least 16,404 feet each in a closed circuit, without touching the ground or the water, the distance to be measured as described in article 4 below.

C—One altitude flight, during which a height of at least 328 feet above the point of departure must be attained; the descent to be made from that height with the motor cut off. A barograph must be carried on the aeroplane in the altitude flight. The landing must be made in sight of the observers, and without restarting the motor.

2. The candidate must be alone in the aircraft during the three tests.

3. Starting from and landing on the water is permitted in only one of tests A and B.

4. The course on which the aviator accomplishes tests A and B must be marked out by two posts or two buoys situated not more than 547 yards apart.

5. The turns around the posts or the buoys must be alternately to the right and to the left, so that the flight will consist of an uninterrupted series of figures of 8.

6. The distance flown shall be reckoned as if in a straight line between the posts or the buoys.

7. The landing after the two distance flights in tests A and B shall be made as follows:

(a) By stopping the motor at or before the moment of touching the ground or water.

(b) By bringing the aircraft to rest not more than 164 feet from a point which has previously been indicated by the candidate.

8. All landings must be made in a normal manner, and the observers must report any irregularities.

Official observers must be chosen from a list drawn up by the governing organization of each country.

The issuance of the certificate is always optional.

End of Annual Maneuvers at Luke Field, H. I.

The period of annual maneuvers ended last week, completing ten days of simulated warfare in which the Second Observation Group participated to the extent of over 150 hours of aeroplane flying time, irrespective of the time flown on engineering and radio test flights and practice flights. This time was divided among the following missions: special patrols, 28; general patrols, 32; artillery reglage, 13; inter-island reconnaissance, 4; special (visual) reconnaissance, 5; photographic reconnaissance, 18; bombing (in formations) 2; attack, 8; night reconnaissance, 4.

The last three days of hostilities were practically a duplicate of the activities of the first three days, in which all available front line troops were concentrated at improved positions on the north shore of Oahu. Photographic and visual reconnaissance flights were made over the sector and contact maintained by our planes with all ground movements. Attack and bombing formations were flown on the concluding day, when the White Forces (enemy) were reported landing troops from transports off Waialua Bay. Patrols operated in all sectors until the evening of the 29th. Two night reconnaissance flights were flown on the 27th and 28th.

The Coast Artillery was also active during the week. Regulation of fire with the Battery at Ahua Point, Fort Kamehameha, was conducted on the 27th. As the target was at sea an HS2L boat was used as the observing plane. On the following day Battery Harlow, Fort Ruger, fired on a land target. A DeH4 plane equipped with a two-way radio set was used successfully in spotting and regulating the shots.

A critique was held at Schofield Barracks by the Commanding General of the Department on Thursday morning. A summary of all situations and movements, which were developed in the maneuvers, was made, and criticisms and commendations were expressed. Some excellent points were disclosed relative to the geography of Oahu, its natural defenses, possibilities for defense and accommodations for troops. The general expression of opinion was one of satisfaction with the work of all organizations.

Anti-Aircraft Work Continues

Langley Field aeroplanes continue to co-operate with anti-aircraft batteries at Fort Monroe during the past week, where some very spectacular work is being done in spouting anti-aircraft fire. The aeroplanes are equipped with the radio telephone and by means of a radio telephone truck located near the battery the battery commander is able to direct the movements of the plane, commanding it at will to fly at different altitudes.

The observer reports his exact altitude by radiophone and the battery fires anti-aircraft shrapnel near the immediate vicinity of the plane, so that the observer can report as to whether the bursts occur above or below the level of the plane. In this way very accurate data is obtained in the timing of shrapnel fuses. The information obtained proves of immense value for all future anti-aircraft work.

Needless to say, the work is somewhat hazardous for the pilot, as a misplaced burst might do considerable damage, but the pilots and observers who are participating in the work seem thoroughly enjoying the added thrill they get out of this kind of practice.

Army D-2 Completed Its Test

The U. S. Army airship, D-2, having completed the test at Akron, Ohio, successfully made the flight from that point to Langley Field via Pittsburgh on October 31. The ship, which was constructed for the Government by the Goodyear Tire and Rubber Company, has a gas capacity of 190,000 cu. ft. The dimensions are: length, 198 ft.; height, 58 ft.; width, 51 ft. 3 in. It has a cruising radius of 550 miles, which may be extended to 790 when running at half-speed, and an altitude distance of 8,500 ft. The ship is fitted with two engines of the Union vee type of 120 h.p. each and making 1,400 revolutions per minute.

The D-2 left Akron at 11 P. M., Saturday, flying by way of Pittsburgh, arriving over Washington at 8:10 Sunday morning, a distance of 285 miles, and reaching Langley Field at 12 M., a distance of 159 miles, making a total of 444 miles flown. The ship, which was in command of Capt. George W. McEntire, carried two pilots, a bombing pilot, a radio operator and two mechanics.

The D-2 will be used for training purposes while at Langley, and later will go to Aberdeen Proving Grounds for bombing work.

Thirty-four at Riverside Polytechnic

Thirty-four enlisted men of the command are attending school daily at Riverside Polytechnic high school. In addition over a hundred men are enrolled in the various educational and vocational classes conducted on the field under expert instructors. The E & R School, which is under the direction of Lieut. F. B. Wieners, bids fair to maintain the last record of last year, when over 85 per cent of the entire command was under instruction, the highest average for any service school in the Ninth Corps area.

Flying Time Pilots' School at March Field

Thirty ships participated in 198 flights, covering an approximate mileage of 11,905, during the past week. One hundred and seventy hours five minutes were consumed in flights, engaged in, for the most part, by new arrivals, who desired to "refresh" themselves upon returning to the Air Service.

(*Continued on page* 355)

FOREIGN NEWS

Aeronautics at Scottish Universities

For the first time some of the Scottish Universities are including aeronautics in their Engineering course this year. At Gilmorehill, in Glasgow, what is known as a "half-graduation" course of 12 lectures will be given, the course having been mapped out in collaboration with the Scottish Branch of the Royal Aeronautical Society. Mr. L. Bartlett, of the Royal Corps of Naval Constructors, who is at present stationed at the Inchinnan Airship Works of Messrs. William Beardmore & Co., Ltd., has undertaken lectures dealing particularly with rigid airships. He will deliver two lectures, illustrated by lantern slides, in Glasgow, two in Edinburgh, and one in Dundee, on the subject of "Rigid Airships—Design and Construction."

The Blériot Mammoth Up for Nearly Two Hours

The latest four-engined Blériot Mammoth made an extended trial at Buc on November 3. Piloted by Jean Casale it went up to 2,700 metres and flew around for nearly two hours. Casale was accompanied by his mechanic, Smith, and the machine carried a load of 3,600 kilogrammes, which, with the weight of the machine, made a total load of 8,600 kilogs.

Artificial Rainmaking by Aircraft

An experiment in artificial rainmaking was carried out in Pretoria, South Africa, on October 5th by the Union Air Force at the instigation of the Department of Irrigation. The theory war originated in this country by Mr. Hall, a well-known farmer in the Middleburg district of the Cape Province, and has been a subject of discussion in the pages of that elder brother of *The Motor Weekly*, the *Farmer's Weekly*, for some time past.

The Defence Department placed an Avro machine at the disposal of the experimentors and built into it special boxes to hold the sand, with mechanism for releasing it as desired. The sand was contained in two boxes, one holding 25 lbs. which could be released rapidly, and the other containing 75 lbs., which could be spread over the clouds.

Lieut. Holthouse kindly undertook to pilot the machine, and he ascended alone about 2.30 p. m., not knowing what was going to happen when he dropped the sand, though perhaps a little sceptical. An interested group of spectators watched the flight, including Mr. Hall, the Acting Director of Irrigation, Mr. Herdman, the Assistant Director of Irrigation, the Chief Meteorologist, and Captain Lane, of the Defence Department. It took Lieut. Holthouse about half an hour to rise above the clouds, which were some 5,000 feet from the ground. For a short time he was lost to view in the clouds, during which time he released the sand. The spectators looked anxiously for rain, but there were no signs of either rain or dust. The only thing to drop from the clouds was Lieut. Holthouse, who brought his machine to earth in a magnificent spiral dive and graceful landing.

The result of the experiment was not encouraging and it may be concluded that under the condition of the experiment it is not likely that rain can be produced in this way as a practical proposition from a farming point of view. Whether any success will be achieved with other conditions, such as a larger amount of sand or different kind of sand or dust, remains to be seen, and it may be that when suitable machines are available further experiments will be made. Mr. Hall, prior to the experiment, was doubtful whether 100 lbs. would produce any feasible effect, and is still hopeful that larger apparatus will produce good results.

The Government has done what is possible with the machine at present available.

Air Flights (S. A.) Ltd.

A new aviation company, styling itself Air Flights (S. A.) Ltd., has been established in South Africa. The promoter of the company is Major F. W. Honnet.

The object of Air Flights (S. A.) Ltd., are to tour the Union of South Africa, Rhodesia, Portuguese East Africa and the South-West Protectorate, the purpose being to give joy rides and business trips, both local and cross-country; to make a complete set of aerial photographs of each large town and prominent engineering works and lay-outs, also prints of any scenic beauties: to produce films from the air of the Witwatersrand. Victoria Falls and the Zambesi, Kimberley and the Premier mine, also entrance to harbors, etc., of South Africa.

AIR POST OF BANKS

The Air Post of Banks, Ltd. (in formation), London, suspended operations last week pending reorganization. They are due to start again soon and will probably shortly adopt a new title. The excellent and businesslike way in which they have carried on their daily service in each direction has been commented upon by all.

Recent Italian Aeronautical Records

A seaplane Macchi No. 18, type De Luxe, with three passengers, has crossed the Alps, flying over Mount Blanc at an altitude of 15,000 feet.

An Italian aviator, Lt. Umberto Maddalena, has completed a flight from Sesto Calende to Stockholm in a seaplane S. 16. He crossed the Alps in his journey, and in the Baltic Sea he made the flight from Riga-Reva, Helsingford, Aland Islands, to the Swedish coast, a distance of more than 2,500 miles.

The Federation Aeronautic Internationale has announced the recent victory of Lt. Bologna, winner of the Schneider Cup at Venice. In this contest the seaplane made a circuit of 200 marine miles with a commercial load of 550 lbs. This being Italy's second winning of the Schneider trophy, the cup will remain the property of the Aero Club of Italy, and the next race will be held in that country.

Regular Mediterranean Service

A regular non-stop aerial service of 625 miles, the longest in the world, has been inaugurated across the Mediterranean from Toulouse, France, to Rabat, Morocco, by a French concern.

Sleeping facilities are provided, the trip being made at night, and the price of a berth is about $300. The flight takes an average of about ten hours.

The company inaugurating the line claims to have carried on more than 200,000 miles of flying during ten months without a single accident or injury to planes or passengers.

"Aviation, Ltd." Movement

"Aviation, Limited," are canvassing the public of Capetown, South Africa, by means of circulars in reference to a proposal for establishing an aerial service for the conveyance of overseas letters by aeroplane from Capetown to Mossel Bay, Port Elizabeth, and East London, and vice versa. Mails would be delivered at Mossel Bay five hours after the arrival of the mail boat, at Port Elizabeth eight hours, and East London ten hours. The Postmaster-General, it is understood, is unwilling to grant contracts, but has consented to mails being carried by air provided senders or addressees pay the extra cost direct to the aviation company concerned. For obvious reasons this course is impracticable, and the company are now endeavoring to ascertain if sufficient support can be obtained to the scheme for carrying overseas letters at a flat rate of 2d. per letter, irrespective of weight; if so, they will again approach the Postmaster-General on the subject with a view to a workable arrangement.

German Aerodromes for Civil Use

It is stated on the authority of Handley Page, Ltd., that the Inter-Allied Aviation Commission have decided to waive the destruction of the following military aerodromes:

Breslau, Gandau, Brunswick, Fürth, Grossenhain, Hamburg, Paderborn, Schleissheim, and Deveen, near Königsberg.

The following seaplane stations, Kiel, Holtenau, Nordeney, Warnemünde, Lift, and the airship stations, Nordholz, Seddin, and Friedrichshafen, are included in this list.

Fifteen per cent. of the privately owned aeroplane sheds on these aerodromes will be left standing, but the airship sheds in nearly every case will be destroyed. The terms of the Treaty of Versailles will not be put into effect with regard to these aerodromes, as it is in the interests of international civil aerial transport that they should be preserved.

London-Paris-Strasburg-Prague

It is now possible not only to send letters and samples but also goods by air to Strasburg and Prague via Paris from London. Aeroplanes leave Paris daily for Strasburg at 8:30 a. m. and the time taken on the flight is two and one-half hours. Every Monday, Wednesday and Friday the machines are linked up with the aeroplane which continues the journey to Prague, reaching that city three hours later, there being an interval of half an hour at Strasburg, so that the whole distance between Paris and Prague is covered in six hours. The return flights from Prague take place every Tuesday, Thursday and Saturday at 8:30 a. m., connecting up with the Paris machines at Strasburg. It is intended to convert the tri-weekly flights from Strasburg to Prague into a daily service in the near future. The machines in use on the service are of the limousine aeroplane type, with a small cabin comfortably fitted for passengers, the engine being of 370 h.p. The fare is 500 francs single.

Letpadau Aerodrome Site

The Burma Government has acquired 59.73 acres of land in the Letpadau township, Tharrawaddy district, as a site for an aerodrome. Letpadau is a station on the Rangoon and Prome Railway, about halfway between the two towns.

Berlin-Rhine Mail Charges

An extra charge of only one-fifth of a penny per letter over ordinary postal rates is made by the German aerial mail service operating between Berlin and the Rhine.

Aircraft Imports and Exports

The British Board of Trade returns for October show that aircraft to the value of £445 was imported into the United Kingdom as against £386 for September. Exports in this class amounted to £106,954, and re-exports to £913. For the ten months ended October 31 imports amounted to £833,536, against £2,458,128 in 1919; exports £1,683,143, against £548,501; re-exports £65,704, against £900.

New Dutch Seaplanes

The Dutch Navy are making extensive use of seaplanes in the Dutch East Indies, and on the strength of experience with numerous samples of this type of craft, they have entrusted to the firm Van Berkels Patent, Rotterdam, the task of designing and building two-seater reconnaissance seaplanes for use in the tropics.

The machines in question are twin float monoplanes, with the fuselage above the wings, fitted with Rolls-Royce "Eagle 8" commercial type engines. Rigid bracing from the floats to near the centre of each half-span is used in conjunction with a thick wing-section—*i.e.*, they may be described as semi-cantilever wings.

The floats are of the long multistep type, entirely built of duralumin, as East Indian experience shows three-ply to be entirely unsatisfactory as a float material. The machines have a top speed of 112 m.p.h. and a full throttle petrol capacity of seven hours' flying, which gives a cruising range of 1,000 miles. It is hoped that it will be possible in the course of a week or two to give illustrations and complete specifications of these machines.

Opportunities in China

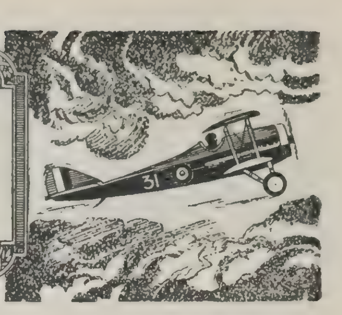
French manufacturers are being urged to consider the possibilities of China. One Frenchman, M. Ricou, has established one service from Makao to Shanghai, but he uses Curtiss machines. A suggestion has been made that waterplane services should be organized over the Hoang-Ho and Yang-tse Rivers and their estuaries. A conference was held on November 17, when M. Painleve reported on his recent observations in China.

Germans' Aeronautic Reparation

From a report received in Paris from Berlin, it appears that up to November 3 the Inter-Allied Aeronautic Commission had taken possession of 28,000 aero-motors—that is, 12,000 more than the Germans said they possessed.

The Commission is also said to have confiscated 18,000 machines, these being, it is understood, in addition to those which have been delivered in accordance with the terms of the Armistice.

ELEMENTARY AERONAUTICS *and* MODEL NOTES



Scale Flying Model of the SE 5 Scout

WHEN America first entered the War, many designs of British Scouts were considered for quantity production in the United States, but the SE 5 was the one most favorably received. Although the SE 5, for some reason, was not put into quantity production in this country, some were built by the Curtiss Company and tested out with good results with a 150 or 180 h.p. Hispano motor. The SE 5 proved very flexible in the air and the simplicity of design made it possible for a duplication of many of the parts, a feature which is essential to rapid production.

The name SE 5 stands for "Secret Experimental Design No. 5."

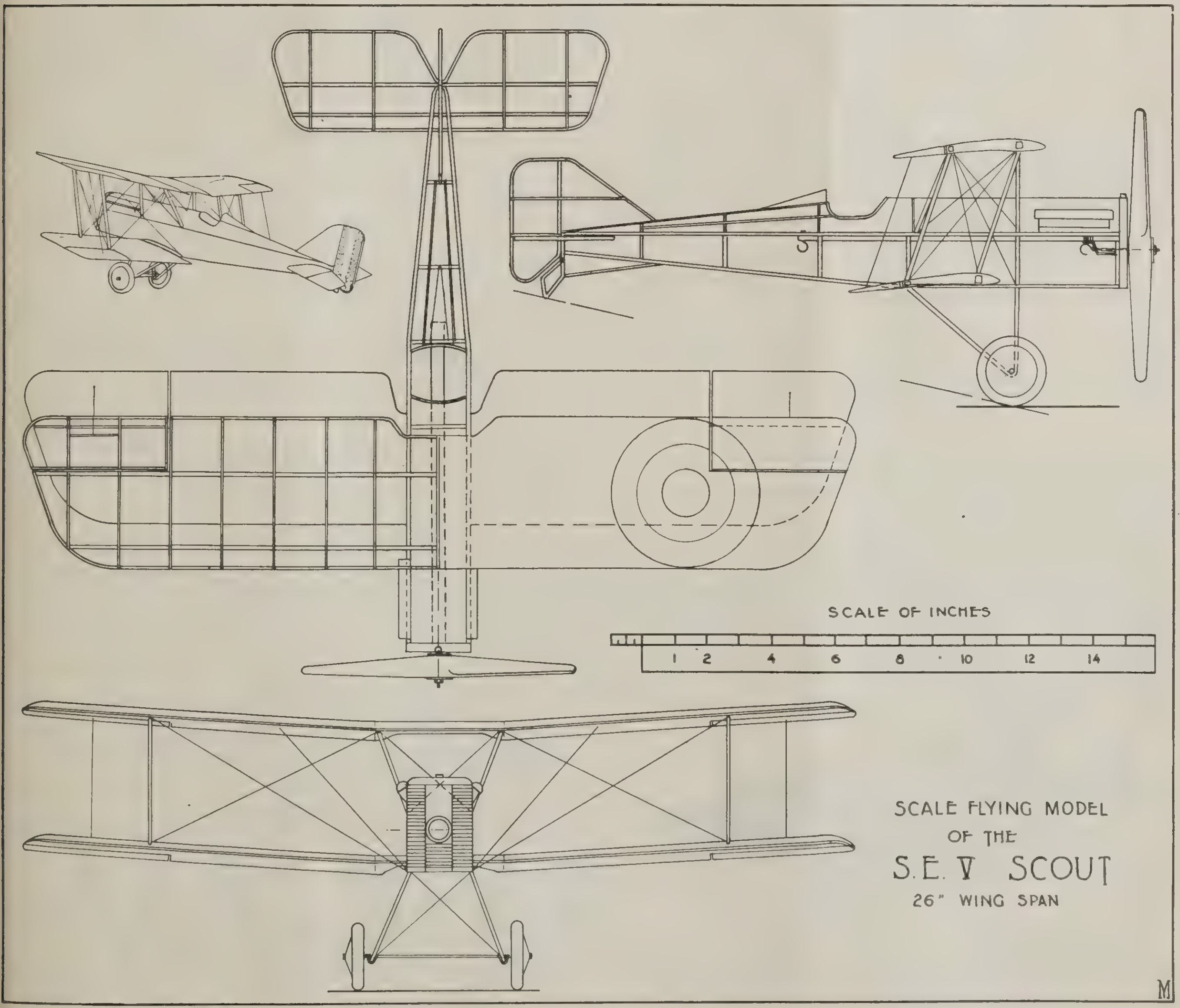
In the actual machine stream line wires are used throughout in the external bracing. The upper and lower wings are similar in general outline and span, with ailerons interconnected from the upper and lower wings by means of single wires The center section and the two small central sections at either side of the body are flat in plan, but the rest of the wing sections have a very noticeable dihedral or slant upward toward the tips. This dihedral gives the machine considerable stability which is helpful for our model.

In every respect the outline given below is in true proportion to the full sized aeroplane, with the exception of the propeller, which, in proportion, is slightly larger, but this cannot be decreased in size if we wish to get the best flight results. The model design takes into consideration the necessity of keeping all the weights well forward so that the completed machine will have the proper balance. On this account a rather heavy propeller may be used. Attention is directed to the fact that all parts of the plane toward the rear must be kept as light as possible.

When the machine is all ready for flight, including the rubber, it should balance at a point about 5" from the face of the radiator, but, of course, this measurement will vary according to the materials used and the manner in which they are placed on our machine.

The drawing gives a "Scale of Inches" by means of which it will be possible for model builders to make their working drawings at full size. As it is most important to the success of this model that the true proportions be observed, the full size drawing should be made before the model is started.

(Owing to limited space, the full description of fuselage, wings, tail works, landing gear, etc., will be published in next week's issue.)



SCALE FLYING MODEL
OF THE
S.E. V SCOUT
26" WING SPAN

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Same Old Story

Jack Spratt bought an aeroplane,
His wife is getting lean,
For 'twixt them both
It keeps them broke
To buy the gasoline.

Flying hen drops egg, says a Sunday headline. The Zeppelin habit is spreading.

In England

Willie Firefly: Mamma, can I go out and play to-night?

Mamma—Yes, Willie, but dim your lights and look out for Zeppelins.

A Flying Trip

An agile young flea, from Milan
Once went to the Alps with a man;
But finding the air
Disagreed with them there,
He returned on a young lady's fan.

Life Insurance

Pat was employed by an aeroplane construction company. As he was leaving the house his wife said:

"Do moind yez don't git hurt, Pat. It's dangerous working in the aeroplane business."

"That's all roight, Biddy," replied Pat. "I borrowed two dollars from the foreman, and he don't let me do any dangerous work any more."

Angry Professor of Aerodynamics: Come now, no more fooling, what year did the Wrights invent the aeroplane? No quibbling, answer "yes" or "no"!

Hokus: I see that the Government turned down all Bill's bids for the Alaskan Aerial Mail Service?

Pokus: What's Bill been doing now?

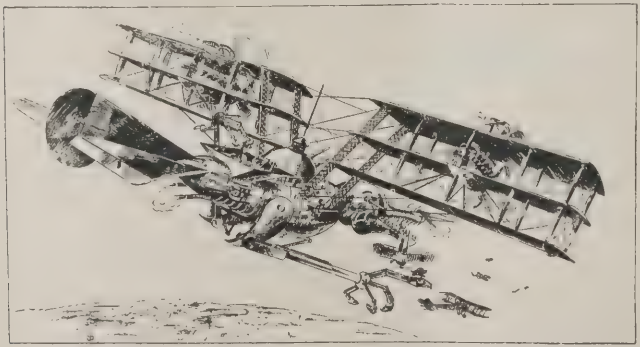
Hokus: Writing an essay on the decline of aviation.

Flight Commander (to aviator who has not enlisted): You ought to be ashamed of yoursesIf not helping your country. Why don't you join the aviation section?

Aviator (with indignant tone): What, with all this war going on? Do you think I'm a poor fool?

American (In London): Why, I always thought that the London hotels were fearfully expensive. I just got a suite of rooms on the top floor of the best London hotel for one pound a week.

Coster: Suite o' rooms nuthin'. Them's the Zeppelin parlors you got!"



—Courtesy "Flight"

The Aerial "Tank" of the Future

Aviatrice—Why is dancing like milk?

Aviator—Strengthens the calf, silly.

(The dull thud of the axe woke the sleeping child next door.)—*Purple Cow.*

Aviator—I was where the bullets were thickest.

She—How brave, and what did you do?

Aviator—I handed out the ammunition.—*Siren.*

Stude (on the aerobus as conductor steps on his foot)—You don't handle your feet very well.

Conductor—What do you want for a nickel—Pavlowa? *Record.*

"You advertised as chauffeurette-maid."

"Yes, madam."

"What were your duties at your last place?"

"I drove and cleaned the cars single-handed."

"And as maid?"

"I took down my lady at night and assembled her in the morning, madam."—*Punch.*

Browning Again

Sharp—That motor is like a youth's fancies in Springtime.

Carp—M-m-m-m.

Sharp—It shows a tendency to spark.

"My ancestors came from a noble line," said the would-be aviator.

"Yes, I noticed it cropping out," replied the instructor.

"Arm. We need more soldiers, a larger navy and a large fleet of aeroplanes. We must have protection. Why in this state of unpreparedness——"

"Sit down, kid. Your lungs are getting rusty. This state is as well prepared as any in the whole United States."

Above the Ground

Belle—Do you believe that matches are made in heaven?

Bella—That isn't where the sulphur is.

The Patient's Idea

Doctor (to hurt aviator)—You've had a pretty close call. It's only your strong constitution that pulled you through.

Patient—Well, doctor, remember that when you make out your bill.

Lexicography

Mr. Popp—Here's a county out in Kansas where every ninth man has an automobile.

Johnny Popp—Oh, Dad, is that what they mean by the submerged tenth?

Words, Idle Words

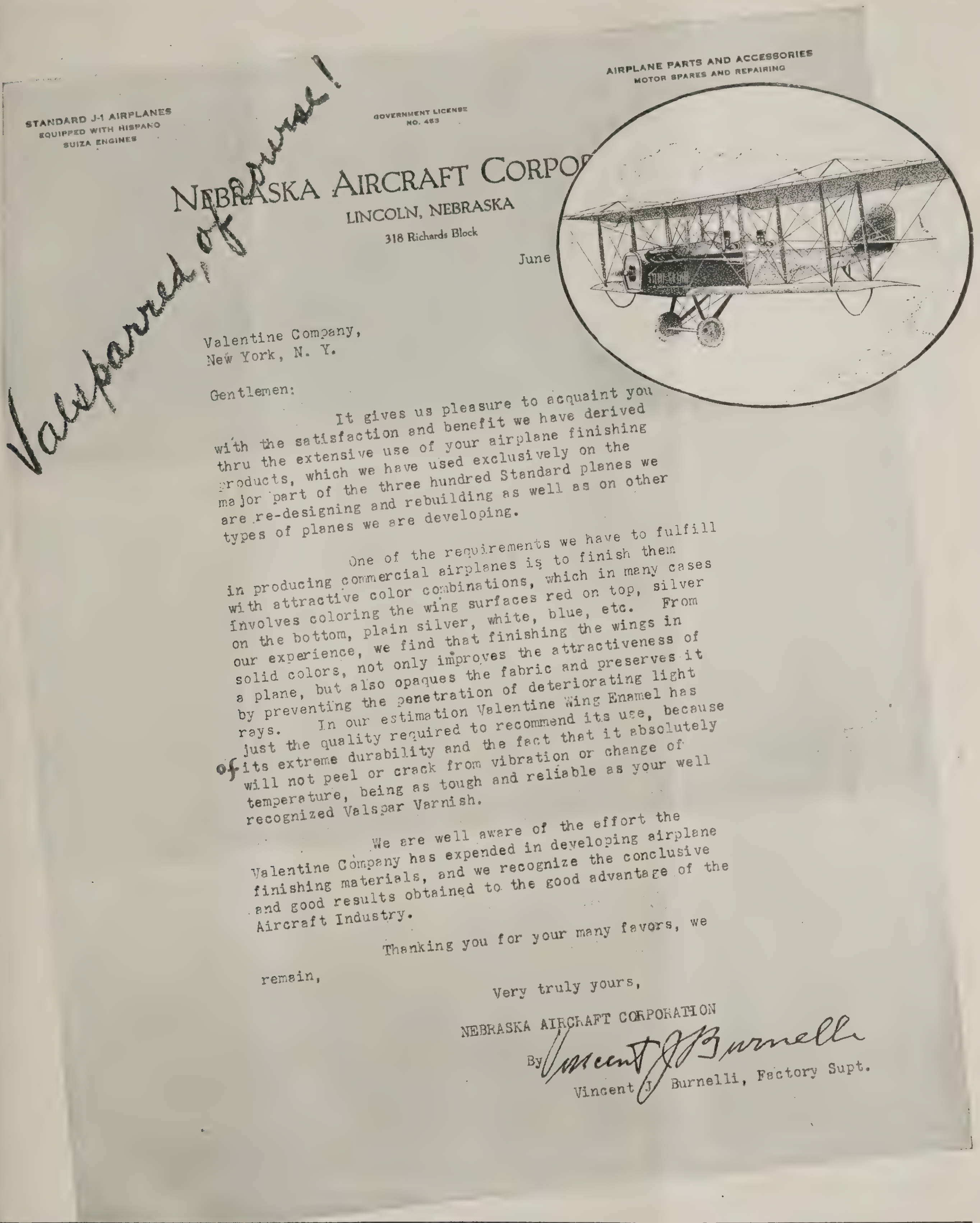
1st Visitor—I see that the English struck a terrible blow at the enemy.

2nd Visitor—Is that so? What did they say?

Expected

Traveling Aviator—Isn't this train pretty late?

Station Master—Yes, she is a bit behind, mister, but we're expectin' her every hour now."



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GOVERNMENT LICENSE
NO. 453

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We are well aware of the effort the Valentine Company has expended in developing airplane finishing materials, and we recognize the conclusive and good results obtained to the good advantage of the Aircraft Industry.

Thanking you for your many favors, we remain,

Very truly yours,

NEBRASKA AIRCRAFT CORPORATION

By Vincent J Burnelli
Vincent J. Burnelli, Factory Supt.

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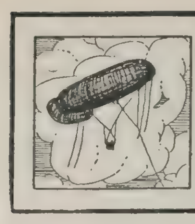


FOREIGN TECHNICAL DIGEST

International Airship Navigation

This article advocates the inauguration of airship lines radiating from Rome on account of its central position.

The routes proposed are Rome—Gibraltar—Fayal—New York; Rome—Gibraltar — Dakar — Pernambuco — Rio — Buenos Ayres; Rome—Paris—London; Rome—Alexandria—Cairo; Rome—Constantinople. The airships would be of two sizes, 100,000 and 50,000 cubic metres capacity, there being 8 of the former for the ocean lines and 9 of the latter for the Mediterranean lines. Allowing for an adverse wind of 5 m.s., New York would be made in 104 hours, Buenos Ayres in 156, London in 21, Cairo in 28 and Constantinople in 17. The cost of installation of the lines, including ships, landing stations, hangars, etc., is estimated at 145 million lire, and the cost of running and maintenance at 111 million per annum. (Lieut. Gill Varoli-Piazza. *Rivista Marittima,* June, 1920. 18 pp.).

Aircraft Engine Design and Insurance

The development of aerial transport for civil purposes must eventually depend upon the support of the investing public, and this support will not be forthcoming unless the proposed company can effect the insurance of its fleet at reasonable rates.

The price paid for insurance will depend upon the safety and reliability of the machines, and in this connection the main factor is the design of the engine. The writer considers that 85 per cent of aircraft wrecks are due to engine failure. The whole future of civil aerial transport is, therefore, largely a question of cooperation between the underwriter and the engine designer. During the war engine reliability was largely subordinated to performance, and these two factors appear to be more or less incompatible with present types of aircraft engines. In engines intended for civil aircraft a larger weight per horse-power will have to be allowed to obtain longer life and greater reliability. A reasonably cheap but reliable engine of 500 b.h.p. weighing 2,400 lbs., and having a life of 2,000 hours, would probably meet all requirements. The writer enumerates several features which seem to call for special attention in the design of such an engine, and amongst other points he advocates the use, if possible, of the two-stroke engine on account of its simplicity of structure and possible low cost; also the adoption of air cooling, and engine speeds below those necessitating overhead cam shafts. A considerable reduction in bearing loads and a general reduction in the number of moving parts seem essential. A simple automatic altitude control system should be employed, and ignition should be provided in duplicate, using inductor type magnetos. It would be preferable, however, to avoid electrical ignition altogether if possible. (Lieut.-Col. W. A. Bristow, *Aircraft Engineering,* Aug., 1920. 9 cols.)

An Extended Theory of the Airscrew

In the simple jet theory of the propeller, the thrust is produced by the acceleration of a jet of fluid having a cross-section equal to the propeller diameter. The kinetic energy in this jet is lost.

It can be shown that under given conditions this loss is a minimum when the jet velocity across the section is constant. This yields a certain definite variation of the angle of pitch of the propeller element with the radius, and gives an upper limit to the efficiency for various degrees of loading ϕ. This factor ϕ is defined as the ratio $S/\rho F v^2$, where ρ=air density, F=jet section, v=translational speed of propeller, and S=thrust produced. The maximum value of the efficiency is given by the expression—

$$2/(1+\sqrt{1+2\phi})$$

In practice, the problem is more complicated on account of the jet having rotational as well as translational energy. The condition of minimum total loss does not now call for a constant velocity distribution across the jet, but a variable one. The author obtains this velocity distribution by the use of certain integrating factors and shows his results graphically. From these a new variation for the angle of pitch with the radius is obtained as a function of the load factor and of the ratio, λ=translational speed of propeller ÷ tip speed of propeller.

The same expression gives a new upper limit for the efficiency under given conditions. The results obtained are shown in the following tables, which give the variation of ϕ and λ for constant efficiency:

η=80%

ϕ	0.1	0.2	0.4	0.6	0.7
λ	1	0.5	0.3	0.1	0

η=60%

ϕ	0.2	0.7	1.2	1.5	2.2
λ	1	0.5	0.3	0.1	0

η=40%

ϕ	—	0.7	2.2	5.0	6.0
λ	1	0.5	0.3	0.1	0

The values of η and ϕ for λ=0 correspond to the simple case of irrotational motion. The theory neglects any contraction of the propeller jet. (A. Betz, *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Apr. 30, 1920. 10 cols., 7 diagrams.)

The Human Machine in Relation to Flying

This is a paper read before the Royal Aeronautical Society of Great Britain by Wing Commander W. M. Fleck. It deals with the medical aspects of aviation and goes in detail into the qualities which are essential in a pilot if the human machine is to function efficiently. The writer's experience is based on a close study of some four thousand pilots in the British services and is one of the most comprehensive contributions to discussion of the subject.

He deals with ocular trouble, the sense of balance, the respiratory mechanism, heart pressure, and concludes his paper by pointing out the importance of periodic overhaul of the human machine engaged regularly in flying. He contends that this is just as necessary as periodic inspection and overhaul of the aeroplane. (*Aeronautics,* Nov. 11, 1920, 3 pp.)

The Gordon-Bennett Entries

This article by E. H. Lemonon, secretary of the Association Francais Aerien, describes the various entries in the Gordon-Bennett trophy race, giving the principal dimensions and characteristics of the Nieuport, Borel, Sopwith, British Nieuport, Martinsyde, Verville Packard, Curtiss, and Dayton Wright. (*L'Aerophile,* Oct. 1-15. 6 pp., 2 illus., 2 diagrams.)

Airship R-80

The trial flight of R.80 took place on July 19th from Walney Island, Barrow. Her construction and equipment are described in this article and some comparisons are made with the earlier airships of the R-33 class.

The speed at normal power is 60 m.p.h., at which the range would be 4,500 miles; at full power the range would be 3,900 miles. The chief features in which the design is an advance on previous airships are: abolition of string netting; lighter and less permeable gas bags; increase in aerodynamic efficiency, strength and rigidity by improvements in the form of the cars; improved arrangement of controls; reduction of head resistance by installation of sliding radiators.—(*Engineering,* July 30, 1920. 10½ cols., 27 figs.)

(*Continued from page* 347)

first at this point. Further shrinkage will cause an extension of the opening.

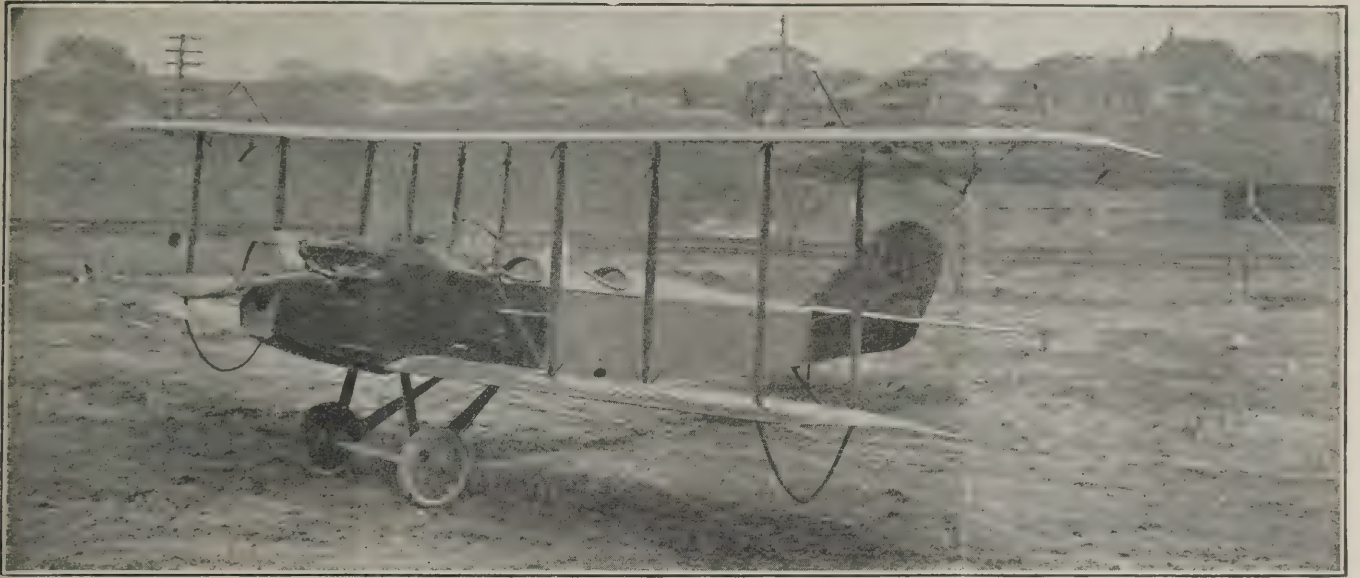
The facts brought out in the above discussion throw a great deal of light on the behavior of ash glued with casein glue. They indicate that the checking experienced was due to the wood losing moisture while being worked, and consequently shrinking and cupping. They suggest as remedies that either the atmospheric conditions surrounding the wood be kept so that the wood will neither gain nor lose moisture, or that pieces of wood with the grain at right angles to the glued joint be employed. They suggest also that the reason that fewer failures have been observed when hide glue was used is that hide glue possesses a higher tensile strength than does casein glue.

With a view to determining the relative values of hide and casein glues when subjected to direct tension, blocks were made up as shown in Fig. 4. Two kinds of wood were used, spruce and ash, and two kinds of glue, hide and casein, with each kind of wood. The specimens were tested in such a way that the glue joint was subjected to pure tension.

The results of the tests showed that there was little choice between hide and casein glues when applied to spruce, either glue possessing sufficient strength to break the wood.

With ash, however, hide glue joints showed over double the strength of those made with casein glue. In fact, the maximum value, 685 lbs. per sq. in., obtained with casein glue was but slightly above the minimum value, 620 lbs. per sq. in., obtained with hide glue.

In conclusion it may be pointed out that the acknowledged superiority of casein glue over hide glue as a water-resistant adhesive may well be questioned when hard woods such as ash or oak are to be joined. Large tensile stresses are undoubtedly set up by the swelling of the wood, and the inability of casein glue to resist such stresses may more than offset its ability to resist the dissolving action of water.



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Harry Hiles, Cheyenne, Wyo., for Southern Wyoming.
Northwest Aircraft Corporation, Newell, S. D., for Western South Dakota.
Erick Aviation Company, Erick, Okla., for Western Oklahoma and Pan Handle.

(*Continued from page* 349)

Advance instruction required 62 hours 25 minutes; forest fire patrol, 37 hours 25 minutes; test flights, 5 hours 05 minutes; and miscellaneous flights, 65 hours 10 minutes.

Army's Largest Dirigible Carries Record Complement

The dirigible Zodiac stationed at Langley Field, Virginia, is engaged in work of carrying officers and enlisted men for training purposes, several flights being made daily. During recent flights a total of 17 passengers have been lifted each flight in the big airship, besides many hundreds of pounds of ballast. This is the largest number of passengers carried by a dirigible in the United States.

Forest Fire Patrol Project for 1921

In connection with the work of aerial patrol of the National Forests in 1921, for the prevention of fires, the Air Service has requested that five reserve squadrons be authorized for this work. This project, submitted by Operations Division, has been approved by the Advisory Board, but to date no authority has been granted to put it into effect.

The 91st Aero Squadron, with headquarters at March Field, Riverside, California, was engaged in forest fire patrol during the past season, and, it is contemplated, will continue the work for the coming year.

The location of squadrons for fire patrol in the Western Department is under the jurisdiction of the Commanding General of that Department.

To Install Reversible Propeller on Aeroplane and Dirigible

Aeronautical designer, Seth Hart, has been ordered to proceed from Dayton, O., to New York on temporary duty in connection with the installation of reversible propellers on Navy Ve-7 aeroplane and dirigible balloon C-10.

To Select Airdrome Sites in Luzon, P. I.

A board of officers, of which Captain E. L. Canady and Roy S. Brown are members, has been appointed for the purpose of selecting possible airdrome sites in Northern Luzon.

One base on the Lingayen Gulf, suitable for both land and sea planes, and another in Ilocus Norte will probably be selected.

Captain Brown, with representatives of the civil government, which owns most of the land on the Gulf, and a greater portion of the province of Ilocus Norte, will make a final trip to the proposed sites this week.

With landing fields established on the northern points, a trip that now takes from three to four days can be accomplished by air in less than an hour.

The inspection trip of Captain Brown will probably take from 10 days to two weeks.

Should a site on the Lingayen Gulf be secured, a gunnery range will be established there, and during the last month of their course the officers taking observers' training will be sent there for final practice.

The only sites in the vicinity of this station which are at all suitable for aerial targets are in a very mountainous region, and it is desirable to avoid work over them if possible.

Society of Automotive Engineers Organizes Washington Section

Washington, D. C.—At a meeting held in the Cosmos Club, November 20, local members of the Society of Automotive Engineers organized a Washington Section. The meeting was opened by C. H. Young, who introduced Coker F. Clarkson, Secretary and General Manager of the Society. Mr. Clarkson sketched briefly the origin of the Society and its development to its present position.

Capt. St. Clair Street, Air Service, followed with a very interesting talk on his flight to Alaska and return. Capt. Street drew some remarkable comparisons between the time made from point to point on his trip and the traveling time by present means of transportation in parts of the Territory. His enthusiastic comments on the performance of the Liberty motors, with which the planes were equipped, were of particular interest, in view of the part taken by members of the Society in the development of this engine.

After the talks the Washington Section was formally launched and Dr. H. C. Dickinson, of the Bureau of Standards, was unanimously elected as Chairman. Col. F. H. Pope was elected Vice-Chairman, Archibald Black, Secretary, and Conrad H. Young, Treasurer. An informal session followed, when the chair threw the floor open to all present for the discussion of the proposed Section activities.

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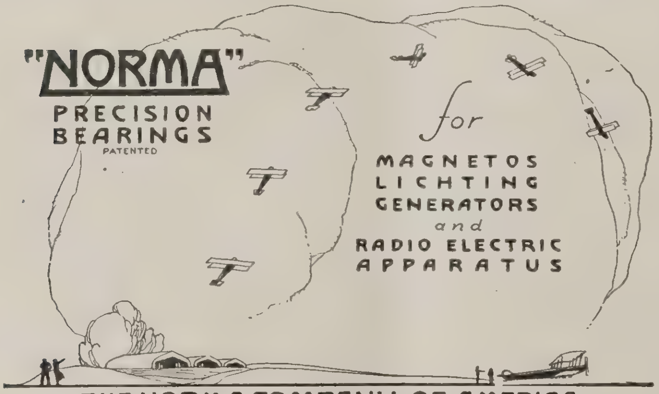

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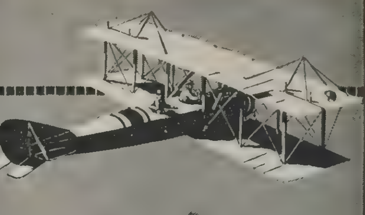

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Annual Report of the Director of the Air Service

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ANNUAL REPORT OF THE DIRECTOR OF THE AIR SERVICE

THE annual report of the Chief of the Air Service to the Secretary of War has just been made public. Following is a comprehensive digest of the document:

I. Organization, Past and Present—Office of the Director of Air Service

The organization of the Air Service, effected in March, 1919, and perfected by June 30, 1919, has been continued in force with but few minor changes during this fiscal year. This organization, modeled upon the proven staff organization of the American Expeditionary Forces, has satisfactorily met the unusual demands of the year, and it is believed that with a minimum of change it will successfully withstand the tests of war. The present organization includes the Bureau of Aircraft Production, the United States Spruce Production Corporation, and the Air Service Claims Board, which are to be retained only until their work has been completed.

Department of Military Aeronautics and Bureau of Aircraft Production

The old organization of the Air Service existent prior to 1919 included two main departments—the Department of Military Aeronautics and the Bureau of Aircraft Production. The principal functions previously performed by these departments were merged in the reorganization of the Air Service on March, 1919. The Department of Military Aeronautics has existed in name only during this fiscal year, and was abolished by the reorganization act of June 4, 1920. The Bureau of Aircraft Production has functioned as such in the settlement of its war contracts and claims and in the discharge of the duties and responsibilities placed upon its director by the act of Congress authorizing the United States Spruce Production Corporation. The Bureau of Aircraft Production must be retained until the final liquidation of the affairs of this corporation and for the settlement of a few remaining claims of its own.

The United States Spruce Production Corporation

During the war it was found that the supply of aeroplane lumber from civilian sources would be insufficient to supply our needs and the needs of our allies. To meet this situation, the Spruce Production Division of the Signal Corps had been formed in 1917. More than two-thirds of our aeroplane lumber production was shipped to our allies. In order to expedite the financing of this work and to facilitate the accounting transactions, the United States Spruce Production Corporation was formed in August, 1918, under the control of the Director of Aircraft Production, as authorized by the Army appropriation act of June 30, 1918. The number of directors of this corporation has been reduced from seven to three during the fiscal year. This reduction was possible because the only work now being performed by this corporation is that incident to its liquidation and dissolution.

Claims Board

Upon the reorganization of the Air Service in February, 1919, the Board of Review, which had formed part of the organization of the Bureau of Aircraft Production, became part of the Board of Review of the Air Service. Its membership remained unchanged, and in addition to its former functions this board was instructed to carry on the work previously performed by the Board of Contract Review of the Division of Military Aeronautics. It was further charged with the settlement of claims arising under contracts previously entered into by the Bureau of Aircraft Production and the Division of Military Aeronautics.

On March 10, 1919, this Board of Review was designated as the Air Service Claims Board.

In order to expedite the liquidation of war contracts, orders, and agreements by the Air Service Claims Board, its membership was increased to nine in August, 1919. This increase permitted the division of the board into two operating sections, each of which acted as an independent board empowered to decide claims. One section acted formally upon claims in the morning and had the afternoon free for the informal study of the claims assigned to its members. The other section studied these claims in the morning and held its formal session in the afternoon. The chairman of the full Board of Review presided over the formal sessions of each section. This arrangement proved very satisfactory, as it furnished opportunities for the proper study of the claims to be decided and at the same time provided a legal board before which claimants might appear throughout the whole day.

In February, 1920, the Claims Board began the consideration of claims presented by those who had entered into contracts to produce castor beans. There were quite a number of these claims, as there had been nineteen such prime contractors and approximately 10,000 sub-contractors. As the claims of these contractors were presented along the same general lines, their handling was expedited by assigning consideration of all of them to one section of the board, while the remaining section gave its attention to other claims.

This board will remain a part of the Air Service organization until its work is completed.

Organization as of June 30, 1920

The close of the fiscal year finds the Air Service established as a separate and coordinate branch of the line of the Army. Interest in the organization established to perform its duties and meet its problems justifies the inclusion in this report of the charts shown opposite this page, which show the organization of the Air Service at the close of this fiscal year and the activities under its control.

Comparison with the organization at the close of the last fiscal year discloses the loss of the Appropriation, Disbursement, and Property Account Sections, which were transferred to the office of the Director of Finance in August, 1919, and the addition of a Finance Contact Section, which was established to secure necessary liaison with the Director of Finance. These changes were made necessary by the concentration of all money and property accounts under a Chief of Finance.

II. General Developments

A general description of the functions of other bureaus and outside agencies cooperating with the Army Air Service is contained in this chapter, together with a brief account of certain events and developments affecting the whole field of aeronautics.

Joint Army and Navy Board

The Joint Army and Navy Board considers questions involving joint action of the Army and Navy and all policies affecting the national defense, and makes its recommendations thereupon to the Secretary of War and to the Secretary of the Navy. As a consequence of its duties, this board considers and makes recommendations concerning the policy of the War and Navy Departments with regard to the tactical and strategical functions of aircraft and the location of air stations. The Joint Army and Navy Board has further contact with the Air Services of the Army and Navy in reviewing and making recommendations upon many matters that have been considered first by the Aeronautical Board.

The Aeronautical Board

As early as October 11, 1916, the Secretary of War suggested to the Secretary of the Navy the organization of a "Joint Army and Navy Board for the Consideration of the Development of a Zeppelin Service." This board was the embryo of the Aeronautical Board, although its functions were enlarged and its name was changed several times before its final development into "The Aeronautical Board." On June 20, 1919, this organization addressed a communication to the Secretary of War and to the Secretary of the Navy, requesting that definite regulations defining its scope of action be established, and recommending that its personnel be increased and employed in the consideration of all aeronautical affairs in which the Army and Navy were interested. Such a precept was approved on June 24, 1919, and a board constituted with a personnel of six voting members, three from the Army and three from the Navy, and a secretary and a working committee under the name of the Joint Army and Navy Board on Aeronautics. On December 29, 1919, this board finally became The Aeronautical Board. In January, 1920, ten additional officers—five from each service—were assigned to the Aeronautical Board to constitute a technical committee and take over the work previously performed by the Joint Technical Board on Aircraft Except Zeppelins.

The powers conferred and the functions allotted to this board are described in the discussion of the "Functions of the Army Air Service and of the Navy Air Service" in Chapter III of this report.

Board of Surveys and Maps of the Federal Government

This board was created by an Executive order dated December 30, 1919, for the purpose of coordinating the activities of the various map-making agencies of the Government and of preventing unnecessary duplication in their work. The work of this board has been and is being performed through standing committees, on two of which representatives of the Air Service are serving. These are the Committee on Information and the Committee on Photographic Surveying.

A series of tests were held in the last months of this fiscal year to determine the availability and economy of aerial photography in map making and in topographical surveying. Exhaustive data were compiled on the tests, but at this time the results obtained have not been studied sufficiently to warrant the determination of future policies.

A prime reason for the Alaska Flying Expedition, plans for which have been initiated during this fiscal year, is the investigation of conditions that affect the photographic mapping of inaccessible areas in Alaska. The Corps of Engineers and the Geological Survey have estimated that it would cost a minimum of $10,000 and require three seasons' work by one surveying party to accomplish by former methods work which the Air Service believes may be accomplished at a much lower cost and within less than one week of flying by one aeroplane. The area which this expedition will investigate lies north of the sixty-sixth parallel and contains 3,500 square miles. This area includes the upper Yukon Flats, and is a mountainous district. A survey of such an area by ground methods would be only partially accurate and the work would be attended by great difficulties.

Considerable progress has been made by the Army Air Service in standardizing the form for aerial maps, so that, despite the greatly increased number of landing fields, a pilot can easily ascertain from the number of the field the name of the town, its location, and relation to other cities and landing fields. Much data has been compiled on landing facilities and valuable information obtained in regard to air currents.

Ordnance Technical Staff

The Ordnance Department is charged with the design, development, procurement, and supply of aircraft armament, including fixed and flexible aircraft machine guns and aircraft cannon and their ammunition; bombs, bomb racks, and bomb sites.

The Ordnance Department has arranged for Air Service representation on the Technical Staff of the Ordnance Department. This arrangement has worked very satisfactorily and the Ordnance equipment furnished the Air Service has been constructed along lines to meet the tactical and engineering requirements of the Air Service. It is believed that the Ordnance Department is the proper agency to handle the matter of aircraft armament, but so long as the estimates are based upon requirements furnished by the Chief of Air Service (and this must be done until such armament is standardized), it is believed that the appropriations therefor should be expended only on recommendation by the Chief of Air Service.

War Department Technical Committee

The Air Service is represented on the War Department Technical Committee, which consists of representatives from the General Staff and from all bureaus and services charged with duties in connection with the supply of the Army. Through this representation the Air Service has maintained liaison with the Services of Supply.

The National Advisory Committee for Aeronautics

During the past year quarters at Langley Field, Hampton, Va., have been supplied to the National Advisory Committee. The Air Service has placed at their disposal all the facilities at this field, and in every feasible way has endeavored to aid this committee in pursuing its research work in aerodynamics. In order to prevent duplication of effort, an understanding was reached and an agreement was entered into between the Air Service and the committee defining the class of work to be performed by each.

(To be continued)

Use the R. M. A's to Sell Aeronautics

OFFICERS of the Air Service, who saw service in the war, and who enlisted in the reserve forces, find it difficult to secure an opportunity of keeping their air sense alive by being unable to make occasional flights, and yet at this time they might be made the most potent force in selling aeronautics to the American public.

The general public must take a far greater interest in aeronautics before it becomes one of the accepted modes of locomotion and every use should be made of every facility to achieve this desired result.

It is generally true that once a person has made his first trip, he is an air enthusiast thereafter, and his circle of personal friends hear about little else for a considerable period afterwards. Let the Air Service, then, make it possible for the reserve pilots to secure planes, let them visit the smaller towns and there invite one or two of the prominent citizens to make trips. This will serve the double purpose of keeping the pilots in training, and waking up the communities to air travel. It may even do more, for if the pilots were equipped with the proper information they might in very many cases be able to persuade such dignitaries as mayors and chairmen of chambers of commerce to busy themselves about equipping their cities with at least passably good landing fields.

In each community so visited by a reserve aviator the lucky persons to make the flights would be converted automatically, aeronautics would be the subject of much conversation, and newspaper space, and we would be getting closer to the aerial age.

THE NEWS OF THE WEEK

Miners May Use Aroplanes in the Sierras

Grass Valley.—Faced by impassable winter barriers isolating them during the winter season, and desiring to keep in touch with the outside world, miners in the Sierra have urged upon business men the establishing of an aeroplane line which would be an all-year-round service medium.

To test out the idea local men sent an aeroplane over a tentative route.

With Pilot Eldredge at the wheel and carrying two passengers, the plane made a circuit of approximately sixty miles over the mining region, landing just 51 minutes from the time of starting.

Heading first for Colfax, the plane passed over the following places where mining is being conducted:

Morning Star, Iowa Hill, Birds' Flat, Little York, You Bet, Red Dog, Nevada City and the Grass Valley district.

The most of these places are off the railroad and on very poor roads, and it is estimated that it would require eight hours to reach them with the most powerful automobile.

The cost of fuel and oil for the trip was calculated at $3.18. It is stated that small mines are often forced to close down by reason of breakage of machinery and difficulty in getting in repairs, thus losing valuable time. To overcome this, an aeroplane service has been suggested.

Raise Funds by Aeroplane for Memorial Hospital

A new and effective service to be performed by aeroplanes was demonstrated recently when eleven De Havilands and a Caproni took off from various towns in Texas in an endeavor to stimulate interest in the effort of the American Legion of Texas to raise funds for the hospital for ex-service men who are victims of tuberculosis. This hospital is to be located at Kerrville and it was necessary to raise $350,000 by November 11. By proclamation of the Governor of the State, November 6 was designated as American Legion Memorial Tubercular Hospital Tag Day, and 300,000 copies of the Governor's proclamation were dropped from planes over Texas towns to the number of one hundred and twenty. These towns range in size from the cities such as Dallas, Houston, San Antonio and Austin to smaller villages of a few hundred population. The city of San Antonio was covered by a formation of five SE-5's. In addition to the Governor's proclamation, thousands of copies of Air Service Recruiting literature were dropped.

Spokane News

Twenty business men of Toppenish, 150 miles west of Spokane, have signed an agreement to furnish the use of six lots free to the Curran Airplane Manufacturing Company, which plans construction of a plant. The agreement provides that within six months the company is to have started construction of a gas plant and a plane factory and that within one year is to have one aeroplane in passenger service and acetylene and oxygen gases on the market.

The Day's Work

Another instance of how the aeroplane can help out in an emergency was demonstrated Saturday when two Curtiss aeroplanes took to the Ferguson Coal Company of Cleveland, Ohio, 525 pounds of parts. This was done in response to a hurried call made by the officials of this company when they found their crane badly in need of parts. The trip of 126 miles was made in two hours.

100-Passenger Caproni

The giant Caproni airship, The White Eagle, is nearly ready and is expected to leave Italy soon for the United States. She is built to carry one hundred passengers.

Cleveland's Municipal Seaplane Dock

Thomas F. Dunn, president of the United States Aerial Express, has presented a plan to the city officials of Cleveland for the building of a municipal seaplane dock, which he says will make this city the center of commercial air service in the United States.

New Aerial Mail Record

All records for flying between Chicago and New York were broken Dec. 2nd by the Air Mail Service. J. T. Cristensen, leaving Chicago at 6:55 A. M., flew to Cleveland, 319 miles, at the rate of 117 miles per hour, and W. L. Smith flew from Cleveland, to New York at the rate of 151 miles per hour, arriving there at 1.25 P. M. An average speed of 131 miles per hour was maintained between Chicago and New York—an air line distance of 742 miles. The actual flying time between these points was 5 hours and 31 minutes. The fastest train time is 20 hours. De Haviland single-motored planes were used, a change of plane being made at Cleveland.

James Means, Pioneer of Aviation, is Dead

Boston—James Means, a pioneer in aviation, whose writings inspired the Wright Brothers to the interest in flying that developed the first practical plane, died at his home here Dec. 2nd. His ideas and visions of the possibilities of aviation were set out in the *Aeronautical Annual,* which he founded and published for several years in the 90's. He was supported in his views, by Prof. Langley and by

Mt. Hood, Oregon's famous Glacier-clad peak, near Portland, upon the summit of which may be discerned a forestry look-out station

Octave Chanute, who contributed to his columns the results of their researches.

It was in the *Annual* that the Wrights found their inspiration, according to a speech by Orville Wright, in this city four years ago, when he paid high tribute to the services to aviation of Mr. Means.

Naval Reserve to Get Seaplane

According to advice received from the Navy Department, a Macchi-Nieuport type 160-h.p. seaplane, equipped with dual controls for instructive purposes, will be sent to the Sumerville station of the Naval Militia early next spring. This machine will be in charge of the Aviation section, Third Battalion, New York Brigade of the United States Naval Reserve Force, and will be for the purpose of giving men anxious to learn something about flying an opportunity to do so without enlisting in the regular navy.

30 Aeroplanes Will Welcome Harding

Newport News.—The destroyer which is to take President-elect Harding and party from the Pastores at Cape Henry will steam direct to Newport News instead of landing at Old Point Comfort.

As soon as the Pastores arrives inside the capes December 4 wireless telephonic communication will be established with a fleet of thirty aeroplanes and two balloons, which are to act as escort of honor for Senator Harding. Inspection of the shipyard where two battleships and two battle cruisers are under construction, a brief program at a local theatre, and separate luncheons for Senator and Mrs. Harding, will constitute the major features of entertainment here, after which the party will leave for Norfolk.

Insurance Men Meet

At a meeting of the National Aircraft Underwriters' Association held November 30th at 140 Nassau Street, New York City, a report was presented by Edmund Ely, president and chairman of the Executive Committee, National Aircraft Underwriters' Association, strongly urging the immediate enactment by the new Congress of Federal laws regulating aerial transport.

The National Aircraft Underwriters' Association, the Manufacturers' Aircraft Association and the Aero Club of America are urging the necessity of adequate aerial laws.

Mr. Ely's report states "A potent influence toward stabilizing and safeguarding flying will be the enactment of suitable federal legislation and the provision of adequate machinery to secure its enforcement, so that the rights and duties of aircraft will be laid down. Granting that proper insurance protection is essential to successful and widespread commercial operation of aircraft, it should be borne in mind that the passenger-carrying ship in times of peace is the potential bomber in times of war. In the face of intensive cultivation of the art of flying abroad, it is the plainest common sense as well as the patriotic duty for the insurance interests to devote such time and thought to the subject as will enable us to assist in the establishment of equal standards here. Consideration of commerce, national pride and national safety urge us to give all possible furtherance to flying development in this country, and we solicit the continued and whole-hearted support of our membership and the entire insurance fraternity."

The following officers were elected for the year: President, Edmund Ely of the Automobile Insurance Co.; vice-president, E. S. Martin, of the Home Insurance Co.; secretary, E. H. Payne, of the National Library Insurance Co.; treasurer, J. D. Lester, of the Globe and Rutgers Insurance Co.; assistant secretary, R. J. Smith, of the National Aircraft Underwriters' Association.

Receivership for L. W. F. Company

The L. W. F. Engineering Company of College Point, L. I., went into the hands of a receiver December 2 as the result, according to a statement authorized by Ernest Whitbeck, the receiver, of the failure of the Government to aid aeronautics.

The L. W. F. company was organized in December, 1915, and was capitalized at $1,000,000. During the war it employed at one time 2,200 men, about the same number now employed in the whole American industry. It is said to be the eighth plant to go out of business since the armistice was signed.

In the statement occurs the following:

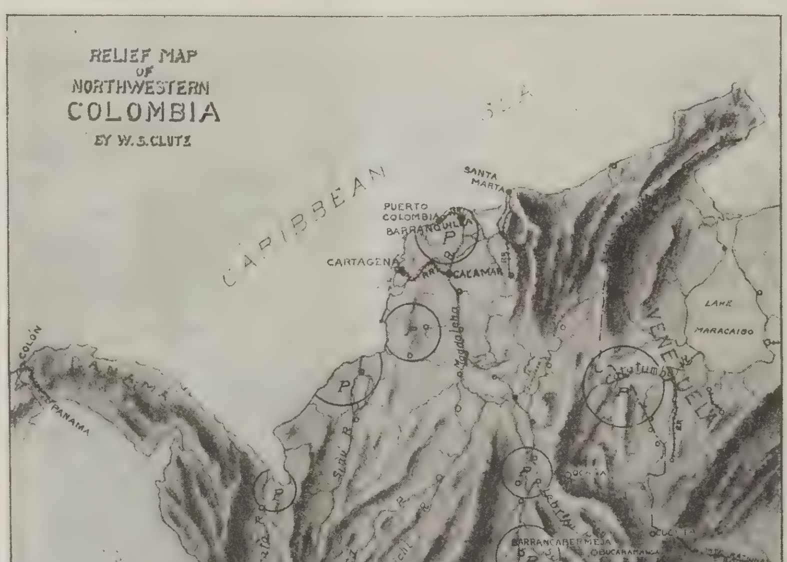
"By a remarkable coincidence, in the annual report of the Chief of the Air Service, Major-Gen. Charles T. Menoher states, 'Unless the Government aids the aeroplane industry it cannot hope to depend upon the availability of suitable commercial aircraft and facilities for their employment nor upon the existence of manufacturing plants and supplies of materials necessary for the rapid production of aircraft in time of war.'"

The statement also says that the receivership of the L. W. F. company "is the result of the failure by the Government to evolve and put into operation a definite aeronautical policy or program."

In recounting the trials of the company it is stated: "Since the armistice the L. W. F. company has endeavored against heartbreaking odds to bridge over the period between military production and peace-time development. The Government has so far neglected to recognize its responsibility in the utilization of aircraft in national defence as to fail, in the two years since the armistice, to prevent the dumping of foreign surplus equipment, to enact an aerial code which would have facilitated commercial business, and to permit orders to be placed for equipment for which Gen. Menoher states the air service is sorely in need."

The L. W. F. plant covers five city blocks. The company has its own flying field and seaplane harbor. It was the originator in this country of the laminated wood fuselage now largely used in aircraft construction, and built the plane first to use the Liberty motor. It constructed both land and water aircraft.

The president of the company is Bradley Fenn. The vice-president and general manager is Albert H. Flint. No statement has yet been made concerning the assets and liabilities of the company.



Sketch-relief map showing the geographic features of the populated portion of Colombia, S. A. Principal mountain ranges, rivers and cities are indicated, and also the mining regions (M) and petroleum regions (P) that are at present receiving unusual attention from large American and other foreign interests. The possibilities of establishing air routes to these important centers is engaging the interest of the progressive Colombian government, which is encouraging outside aid to develop commercial aviation

The AIRCRAFT TRADE REVIEW

Goodyear Plans $30,000,000 Issue

The Goodyear Tire and Rubber Company plans to issue $30,000,000 of first mortgage bonds provided that its stockholders approve such an issue at a special meeting to be called, according to information received by the press from the company's main offices in Youngstown, Ohio. That financing will be the one of a permanent nature described by bankers when a banking credit of $25,000,000 was extended as a temporary measure. The bankers connected with the banking credit were in Chicago and in New York, and it is understood that that banking group will handle the company's permanent financing as soon as its details and formalities be completed.

Varney to Install Anti-Fire Device

Walter T. Varney has just concluded arrangements with Mr. W. A. Ross, president of the W. A. Ross Co., Inc., for the installation and equipment of the War-Inc Anti-Fire Devices in all planes sold by Walter T. Varney. The greatest danger of fire in aeroplanes comes, not from the fact that the planes are built of inflammable material, such as linen and wood. This is proven by the fact that some of the all-metal planes which have been flying in this country have had fires which have resulted in fatalities to the pilots and mechanics. As is well known in the automobile world also, many all-metal machines result in fire losses, and for that reason fire insurance is carried on them. The greatest source of fire for both aeroplanes and automobiles is the fact that they both carry gasoline, and wherever gasoline is carried there is the ever-present possibility of fire. In the plane itself fire can be occasioned in the air through leakage of gasoline leads or back-fires through the carbureter. It also may be caused as a result of crashing when the gasoline tank is broken and gasoline is poured over the hot motor.

Mr. W. A. Ross has gone very deeply into the matter and has found a method of eliminating or rather of putting out fires occurring in any possible way as a result of the presence of gasoline. Mr. Ross holds the basic patents on all these methods and as a result of his demonstration Walter T. Varney has exhibited his usual progressive attitude in regard to safety appliances and is equipping the Bristol and Lincoln-Standard aeroplanes with the War-Inc devices. In order to make the material in the plane itself fireproof, Phenix fireproof dope is being used for covering on the wings and on the wood. The combination of these will result in an aeroplane practically 100 per cent fireproof.

In order to eliminate the dangers due to actual breakage of planes in the air, and also to eliminate the dangers of crashing due to landing in mountainous countries, Mr. Varney has equipped a Lincoln-Standard with the well-known Broadwick parachutes, for the purpose of testing the use of parachutes in aeroplanes. These tests are to be made in the near future and if the result is satisfactory, Mr. Varney will equip all his planes with the Broadwick chutes.

With both the parachutes and the fireproofing equipment, the purely accidental dangers of the aeroplane are almost entirely cut out—as much as is mechanically possible, and the aeroplane should become as safe in use as the automobile; the only remaining element of risk being the personal element—the bad judgment, the inexperience, or the recklessness of the pilot.

Mr. Upson Leaves Goodyear Company

Ralph H. Upson announces his resignation as chief aeronautical engineer of the Goodyear Tire and Rubber Company. Mr. Upson expects to be associated with several Detroit capitalists in the operation of an inter-city passenger, freight and express airship service.

Swann Joins J. L. Aircraft Corporation

Mr. Swann, formerly of Interallied Aircraft Corporation, is now associated with the J. L. Aircraft Corporation, 347 Madison Avenue.

Howe Synchronizer Company

The Howe Synchronizer Company was incorporated with a capitalization of $24,000 at Columbus, Ohio, recently. The company intends to engage in the manufacture of fans, motors and synchronizers, patents for which have been obtained by Fred C. Howe, formerly employed at McCook Field. It is said that the synchronizer will be used on aeroplanes and may be used on automobiles and other machines.

Efforts are being made to have factory located at Dayton, Ohio.

Stinson Takes Over Flying Field

The Dixie Flying Field, Birmingham, Ala., has been taken over by Eddie Stinson and will be made the permanent headquarters of a flying school. Negotiations are in progress to make Birmingham the Southern headquarters for Curtiss aeroplanes and equipment. Announcement to this effect was made by the aviation committee of the Chamber of Commerce.

Mr. Stinson will start his school at once. The equipment will consist of three Curtiss planes. Equipment valued at $20,000 already has been ordered for the school. S. B. Irwin and R. C. McMurray, two well-known pilots, will assist Mr. Stinson.

Special Field Service for Doctors

An all-year emergency service will be maintained at the Wallace Field, Davenport, Iowa, according to announcement by Manager Wallace. The service will be for the special accommoodation of doctors who have emergency calls for country patients or to nearby towns, for professional men and business men who are summoned for emergency affairs.

The hangar accommodates four aeroplanes and is a building 180 by 32 feet with a solid concrete foundation. Tents on the grounds accommodate two other machines at the field.

Manager Wallace calls attention to the fact that while approximately 500 people rode in the planes at Wallace Field the past season there was not a single approach to a serious accident at any time passengers were in the machines.

U. of W. May Purchase Plane

An aeroplane may soon be purchased by students at the University of Wisconsin. The University Aero Club, organized by a number of ex-army and navy aerial officers last spring, decided recently to begin raising money to buy an aeroplane. The end toward which they are working is to establish a flying department in the university military organization.

Personal Par

Alfred Ely, formerly Major, Air Service, and Chief of Radio Section, is practicing law with the firm of Agar, Ely & Fulton, 31 Nassau Street, New York.

The 1,000 H.P. Zeppelin monoplane which, it is stated, will attempt a trans-Atlantic flight

CLIMATOLOGICAL FACTORS GOVERNING THE SELECTION OF AIR ROUTES AND FLYING FIELDS

By C. LE ROY MEISINGER

Introduction

THERE is, it seems, a vagueness in the opinions of many people regarding the value of meteorology in the selection of air routes. One reads of "pathfinding" and of "charting" flights, by which it is implied that a single journey or, at most, several journeys over a proposed course will afford sufficient data to designate that route as satisfactory or unsatisfactory for continued use. Such reasoning is unsound. It is obvious that the aerial medium is possessed of such a host of variable attributes that the conditions which one finds today may not occur again in precisely the same combination for months or even years. Of what profit shall it be to measure the temperature, humidity, and other elements, in a single flight, unless it be that these data are to be used in the discussion of the flight itself, relative to the performance of the motor or instrumental equipment, the physiological reaction of the travelers, or in one or more of the several other problems that may take the form of special tests? If such observations are to be made, they should be made over a wide area, by numerous craft, and as nearly simultaneously as possible. The ocean of air is far from being a fixed thing. Perhaps the likening of the atmosphere to the aqueous ocean is a figure of speech which has been somewhat overdone, and has resulted in the popular conception of aerial currents as fixed as the Gulf Stream or the Japan Current. It is also possible that the pioneer work of Rotch and Palmer, "Charts of the Atmosphere for Aeronauts and Aviators," which appeared in 1911, did not lay sufficient emphasis upon the pitfalls of too great reliance in averages. Our atmosphere is not made up of great permanent streams and currents, and even our conception of prevailing westerly winds aloft is sometimes shocked by the spectacle of cirrus clouds moving from the north, east or south. Therefore, efforts to lay down definite airways without reference to the fundamental conditions which really determine desirable routes can not prevent themselves being relegated to a position of slight importance. It would be unfair to assert that any carefully made scientific observation is of no value; but it is obvious that, in such matters as the selection of air routes, other factors than such observations must be considered before one can legitimately make generalizations upon so subtle a medium as the atmosphere.

The Selection of Routes

It is self-evident that the point of departure and the destination must determine the general direction of flight. But it is by no means axiomatic that the air route shall follow a straight line between these two points. Irregularities of the terrain, its physical characteristics, and the weather along the route must, in the last analysis, determine the course of the aviator, if he is to cover the distance with the greatest economy of time and fuel. In brief, it is the geography and the climate of the region between two stations which must determine the approximate route, but the weather at the time of flight must determine the details of the aviator's course.[1]

While the fact is recognized that a single condition may not be representative of the weather over a given route, and also that mean conditions over the same route may differ greatly from the conditions of any particular day, it is believed, nevertheless, that the best basis for laying out a preliminary route between two points lies in the mean values of certain climatological and aerological factors.

Wind.—Perhaps the most important of all the weather elements to the aviator is the wind. It is necessary in commercial aviation to take advantage of any conditions which will aid in economy of time or fuel or will be conducive to greater safety. If, then, the "pathfinder" is to live up to his name, his first concern must be to determine the speed and direction of the prevailing winds over the proposed route. These winds should be determined, not at the surface alone, but to as great altitudes in the free air as possible. Moreover, it is very likely that he will discover that certain elevations will, in the long run, be more favorable for flying in one direction, and that other levels will be more favorable for the return journey. Rouch and Gain[2] have shown how important such wind studies are in regard to flying in northern Africa. The journey from Oran to Tunis, they find, should be made at an altitude of about 2,000 meters, because at this elevation a strong westerly wind prevails. The return journey, in the long run, will be made most profitably at an altitude less than half as great, because the westerly wind at that elevation is greatly diminished in force. Such prevailing winds should be determined from as long records as are available and should be worked out for small time units; seasonal averages would be valuable, but monthly means would undoubtedly be better. Not less valuable in this connection are the means of diurnal wind changes, both in speed and direction. In fact, each additional factor brings the conditions nearer to those which the aviator is likely to encounter in flight.

Digressions from the great circle[3] path between two points would be most helpful in cases of high winds and relatively slow-moving craft. Thus, a high-powered aeroplane flying at 110 miles per hour in a gentle wind would gain little, if any, by departing from the great circle. But a dirigible, on the other hand, moving at 60 miles per hour, might find it very much to its advantage to follow the general direction of wind flow if the wind speeds were quite high and if the curvature of the wind path were such as eventually to bring it near its destination. Thus, the gain to be made by departing from the great circle becomes smaller and smaller as the ratio of craft speed to wind speed becomes greater.

Cloudiness and Fog.—The influence of the lower clouds and fog upon flying is very great. As a rule, it is essential to retain sight of the earth. When there are low clouds and fog, however, to keep in sight of the earth is obviously a hazardous proposition. The disadvantages of low flying when there is a cloud layer quite close to the ground have been set forth by Prof. B. Melville Jones,[4] as follows: 1. Strain to the pilot, owing to constant bumpiness, poor visibility, and proximity to the earth. 2. Danger of collision, occasioned by poor horizontal visibility. 3. Discomfort to pilot and passengers, since flying above clouds is exhilarating. 4. Choice of altitudes is limited, and therefore it is difficult to select advantageous flying levels. 5. Annoyance to people on the ground. 6. Danger in case of forced landings.

While Professor Jones inclines to the view that overcloud flying has advantages over undercloud flying when the clouds are low, he does not hesitate to point out the danger and discomfort occasioned by having to ascend to great heights to clear clouds; moreover, it not infrequently happens that the cloud layer is thick, or that there are several layers. The danger of flying in clouds is great, not only because of the possibility of loss of sense of balance by the pilot, but because the clouds may reach the ground without his knowledge, thus making a crash likely when attempting to land or descend to lower levels.[5] There is also the danger of being unable to find the landing field at the end of the flight and the difficulty of navigating without visible points on the earth. Whatever may be the advantages of overcloud flying, there is no escaping the fact that low clouds are a menace to the airman.

It is therefore necessary in the laying out of proposed aerial routes to consider carefully the frequency of low clouds and fog. Bodies of water, such as lakes, rivers, and the ocean, as well as cities and deserts, often contribute to the formation of fog and the production of low visibility.

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[1] A later article will show how current conditions may modify an air route with a saving in time and fuel.

[2] Les cartes des vents à l'usage des aéronautes. *Revue générale des Sciences,* Mar. 30, 1919, pp. 168-171.

[3] It is so customary to think of the earth's surface as it appears on a flat map that the fact often is lost sight of that the shortest distance beween two points on a spherical surface is the arc of the great circle upon which the two points are located. This applies chiefly to long distances and is used by mariners; but it also applies in the case of long aerial routes.

[4] Flying over clouds in relation to commercial aeronautics, *Aeronautical Journal,* May, 1920, pp. 220-249. Abstract in *Aeronautics,* Mar. 18, 1920, pp. 240-243; also in *Monthly Weather Review.*

[5] The writer had such an experience in a free balloon. Having ascended into a rather low layer of clouds and having lost all sense of direction, the party was surprised to discover several hours later that the trail rope of the balloon was dragging on the ground. The low clouds had actually reached the surface. For full account, see "A free balloon flight in the northeast quadrant of an intense cyclone," *Monthly Weather Review,* April, 1919. 47: 233-235.

Thunderstorms.—To the pilot of heavier-than-air craft no less than to the pilot of lighter-than-air craft, the thunderstorm is a formidable enemy and one to be studiously avoided. The few who have ever penetrated the interior of a thundercloud have suffered experiences which they would not care to repeat if, indeed, they have come through alive. Dr. Charles F. Brooks has discussed several instances in which aviators have described their experiences in or near thunderstorms.[6]

Lighter-than-air craft are forced into the uncomfortable situation of having to land, or attempt to fly above, or around, the thundercloud, any or all of which may be extremely difficult. In the case of a dirigible balloon, it may be possible to fly around the storm as an aeroplane might do, and thus succeed in avoiding it. The alternative of landing in the face of the oncoming storm with its squall wind is not desirable because of the difficulty of handling the balloon on the ground. To attempt to fly over a towering thunderstorm may be entirely out of the question owing to the excessive altitude which would have to be attained, for great altitude necessitates unpleasant physiological effects and the loss of gas (through expansion) and ballast.

It is true that usually the thunderstorm is essentially a local phenomenon, which may attend the passage of the wind-shift line in a *low* or may be formed locally by strong convection. Thus, the chances of encountering thunderstorms during a given trip are very much dependent upon current general conditions. But the frequency of occurrence of thunderstorms along a given route is a thing that it is vitally important to know. For one may discover that in certain months in a given region the thunderstorm frequency is so great as really to endanger the maintenance of schedules. An aircraft corporation may discover by such statistics that their craft will be placed in great danger by maintaining routes through regions of great thunderstorm frequency. The wisest course in those cases might be to modify the schedule during those times, to select new routes, or to discontinue service in that region temporarily. Again, this knowledge can give some clue to the possibility of profitably modifying the administrative activities of the corporation, such as shifting the personnel of flying fields, distributing equipment, extra parts and supplies. All of these factors will have their reflection in direct financial returns. A blind indifference to the statistics of climate over air routes is, therefore, a narrow business policy, and that corporation which manifests this indifference is the one which, no matter how skilled its pilots, will find its dividends dwindling because of loss of equipment through accidents and consequent loss of popularity with the public.

Temperature.—The knowledge of mean temperatures over routes is perhaps the least important of the weather factors. It is true that temperature has a profound influence upon the maintenance of schedules in extreme weather. But with the improvement of aircraft engines so that they function at extremely low temperatures, and with the electrical heating of the cabins of passenger-carrying planes and dirigibles, the influence of the temperature factor is appreciably lessened. Information regarding average vertical distribution of temperature and of the diurnal change of this distribution is helpful. Unfortunately such data are somewhat limited, but the Aerological Division of the Weather Bureau is conducting a study of a great number of kite flights which will probably supply to a large degree this need. The knowledge of mean vertical temperature distribution is not as important in the preliminary laying out of air routes as in the discussion of the current data supplied to the aviator just before he ascends.

Humidity and Precipitation.—These elements are not of great importance at the outset, and they are so interwoven that their value depends chiefly upon the interpretative ability of the consulting meteorologist at the flying field.

The Selection of Flying Fields

The problem confronting the person whose duty it is to select a flying field is not an easy one; or, at least, it is one that can not be rightly solved by a mere consideration of the civil or military requirements. Today, with the multitude of flying routes being established, it sooner or later becomes the problem of the commercial clubs or chambers of commerce in most large cities to determine a landing field in the immediate vicinity. These fields have a great commercial value to the city. It is not denied that many of the local aspects, such as the availability of property, accessibility, etc., each peculiar to a given locality, rightfully have a foremost place in the consideration. But the meteorological aspect can not be neglected, for it is conceivable that, in spite of a hundred desirable features of a landing field, there may be certain characteristics which, from a meteorological standpoint, will render it utterly unfit for the purpose. Again assuming the climatic features to be favorable, the field itself must be so laid out that it will serve most efficiently. That is to say, for instance, that the long axis of the field, if it be small and rectangular as many are, should lie in the direction of the prevailing wind at the place, because it is necessary that planes land heading into the wind and that they also rise in a headwind. The buildings should be so oriented and distributed as to interfere the least with landing or rising planes, and where the eddies and gusts they cause will not interfere with craft flying low over the field.

A very striking example of the consequences of neglecting the meteorological aspects is given by Rouch.[7] During the war, the British desired to establish a training field for aviators for bombing instruction, and a commission was appointed for the purpose of determining the location. The shore of Loch Doon, in Ayrshire, was chosen. After the work of establishing the field was well along, the hangars were being built, a railroad was contracted for, and other expensive arrangements had been made, it was discovered that the neighboring hills gave rise to eddies and squalls which absolutely prevented safe flying at that place. The field was abandoned with a loss to the Government of upwards of $2,000,000. In conclusion, Rouch says, "The installation of some instruments and the consultation of some tables of figures would have permitted 12 million francs to be saved. In that circumstance, sadly writes the *Times* (London), the authorities did not perform their duty." It is unnecessary to emphasize the import of this example.

The Air Service recognizes the tremendous importance of the climatological considerations in the selection of flying fields.[8] To quote from the circular which discusses this question:

> The number of flying days to be expected in a year or in any month may be fairly well determined from a study of the climatic factor. * * * It is also possible from this study to arrive at a fairly definite conclusion as to the accessibility of the field by aerial routes for different types of aircraft. In other words, one may determine the sort of aerial harbor, ease of entrance, exit, and other things considered which aircraft would find at a given field. * * * The prevailing wind and storm directions largely determine the layout of a field. The number of days to be expected when the wind speed is too high for the operation of aircraft may be closely determined. Also the number of days with excessive precipitation, with fog or storm to be expected, may be closely approximated.

The weather factors to be taken into consideration are quite the same as those which may determine aerial routes. Preciptation comes in for greater consideration in the case of landing fields. A plane can not land or take-off readily on a muddy field, and a snow cover demands the greatest attention.[9] As the Air Service circular points out, topography and wind are inseparably bound together in relation to aeronautics. The effect of wind blowing over a rough terrain is to produce rough air in which to fly. Landing fields in a hilly region are especially apt to be dangerous; and the proximity of trees and high buildings is likely to cause roughness extending to a height three or four times as great as the object. This is dangerous to a plane slowing down for a landing or for slow-flying planes.

Conclusion

An effort has been made to present the vital importance of meteorological studies in connection with the establishment of aerial routes and the layout of flying fields. The argument does not pretend to overstress the use of averages in connection with such work, but it does attempt to emphasize their importance in the preliminary work. Meteorology is the

(*Continued on page 373*)

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[6] The effect of wind and other weather conditions on the flight of aeroplane. *Monthly Weather Review,* August, 1919, pp. 523-532. See also Meisinger, C. LeRoy: A balloon race from Fort Omaha through thunderstorms, idem, pp. 533-534.

[7] Préparation météorologique des voyages aériens. Paris, 1920, pp. 53-54.

[8] Meteorology and Aeronautics. *Air Service Information Circular,* May 12, 1920, vol. 1, No. 77.

[9] A note in *Aeronautics,* Mar. 18, 1920, p. 230, tells of the addition of ski attachments to the plane where landings have to be made on snow. One of the great difficulties of landing on snow, as on water, is to tell how high the aeroplane is above the surface, for, with a perfectly smooth snow cover, it is difficult to judge distance; ;and even to know when the skis are actually in contact with the snow.

A METHOD FOR DETERMINING THE ANGULAR SETTING OF A TAIL PLANE TO GIVE BALANCE AT ANY GIVEN CONDITION

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I. Résumé

THE present method includes the determination of the proper angular setting of a horizontal tail plane to give longitudinal balance at the following flight conditions:

1. Level flight at any speed.
2. Climbing flight at best rate of climb.
3. Gliding at any angle with power off.
4. Conditions 1, 2 and 3 at any altitude.

There will also be included in the report the investigation of the effect of an angular setting to give balance at a certain flight condition on the balance at other flight conditions. In general, this investigation will determine the force on the stick necessary to give balance at full power, and the amount of controllability in a glide with the power off.

The location of the center of gravity of the aeroplane under consideration must be fixed and known. If the area of the tail plane is not known, various areas may be assumed, the consequent tail plane settings established, and a choice of areas made. The center of pressure curve of the aerofoil used, the gap, stagger and location of the wing cellule relative to the center of gravity, and the structural characteristics of the aeroplane must all be known. It is assumed that the stick is held neutral, *i. e.*, the angle of the elevator to the stabilizer is zero.

II. Method

The general procedure is to first set down the fundamental equations for forces and moments, and then to investigate these equations for the level flight condition. Velocities of flight and slipstream velocities are established. The load carried by the wings, and hence by the tail, are found, and empirical equations are introduced which define the angle of downwash and the lift coefficient of the tail. The incidence of the tail to the relative wind required for balance at any incidence of the wings is found, and hence the angular setting of the tail relative to the wing chord.

Fixing the tail setting for balance at a certain velocity, the incidence and lift of the tail for other velocities are found. In this connection, the tail moments are known and hence the forces on the stick to give balance.

It is next shown how the equations of level flight condition are modified for climbing and gliding flight and to what degree the tail righting moments are reduced in the latter case when there is no slipstream effect.

III. Fundamental Equations

The general equations for forces perpendicular and parallel to the wind and for moments about the c. g. are:

$$1.\ L_w + L_t + T \sin \Theta - W \cos \phi = 0$$

$$2.\ T \cos \Theta - D_w - D_t - D_p - W \sin \phi = 0$$

$$3.\ L_w a_1 - L_t a_2 + T a_3 - D_t a_4 - D_p a_5 - D_w a_6 = 0$$

where,

W = weight of aeroplane,
L_w = lift of main planes,
L_t = lift of tail (positive if upwards),
T = thrust of propeller,
D_t = drag of tail surfaces,
D_w = drag of main planes,
D_p = parasite resistance,
ϕ = inclination of flight path to horizontal,
Θ = inclination of thrust line to flight path,
a_1 = distance c. g. to L_w (positive if ahead of c. g.),
a_2 = distance c. g. to c. p. of tail plane,
a_3 = distance c. g. to thrust line (positive if below),
a_4 = distance c. g. to D_t,
a_5 = distance c. g. to D_p,
a_6 = distance c. g. to D_w,
(See Fig. 1)

In general,

$$\Theta\ .\ .\ . = 0, \text{ or practically} = 0,$$
$$T \sin \Theta = 0,$$
$$T \cos \Theta = T.$$

Practically, we may consider that

$$D_t\ a_4 = 0$$
$$D_p\ a_5 = 0$$
$$D_w\ a_6 = 0$$

since D_t, a_4, a_5 and a_6 are very small quantities. $T\ a_3$ can also be neglected in most instances, but it will be included in this method.

IV. Horizontal Flight

In level flight the equations will be modified as follows:

$$\phi\ .\ .\ .\ . = 0$$
$$W \sin \phi = 0$$
$$W \cos \phi = W$$

and the fundamental equations become

$$1'\ L_w + L_t = W$$
$$2'\ T = D_w + D_t + D_p = RV^2$$
$$3'\ L_w a_1 - L_t a_2 + T a_3 = 0$$

from 3'

$$4.\ L_t = \frac{L_w a_1 + T a_3}{a_2}$$

Substituting 4 in 1'

$$5.\ L_w + \frac{L_w a_1 + T a_3}{a_2} = W$$

$$6.\ L_w \left(1 + \frac{a_1}{a_2}\right) + T \frac{a_3}{a_2} = W$$

Let

$$q = \left(1 + \frac{a_1}{a_2}\right)$$

$$7.\ L_w = \frac{W - T \frac{a_3}{a_2}}{q}$$

Also. $\quad 8.\ T = RV^2$

Where $\quad RV^2$ is the total resistance of the aeroplane

And $\quad 9.\ L_w = K_{yw}\ A' V^2$

Substituting 9 in 7

$$10.\ K_{yw}\ A^1\ V^2 = \frac{W - R \frac{a_3}{a_2} V^2}{q}$$

$$11.\ V = \sqrt{\frac{W}{q\ (K_{yw}\ A') + R \frac{a_3}{a_2}}}$$

$$12.\ A' = A_1 + A_2 \left(1 + \frac{v}{V}\right)^2$$

Where $\quad A_1$ = area of wings outside slipstream
$\quad\quad\quad A_2$ = area of wings within slipstream

Since A_2 is small, $\left(1 + \frac{v}{V}\right)$ may be assumed constant and an average value taken for level flight. Appropriate values are,

Single bay pursuit plane............	1.08
Two-bay two-seater................	1.20

In climb, these values would be respectively 1.15 and 1.40.

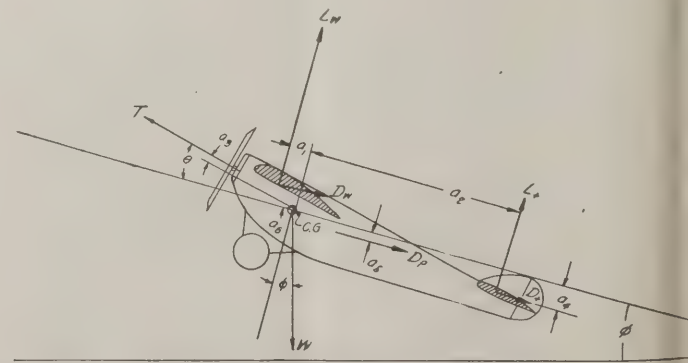

FIG. 1 FORCES AND MOMENTS

$$13.\quad R = (K_x A' + r)$$

where r is the parasite constant in lbs./m.p.h. at the ground, Usual values are

Single bay pursuit plane	.016
Two-bay two-seater	.040

The thrust is equal to RV^2 and is also equal to the momentum imparted to the slipstream by the propeller.

$$14.\quad RV^2 = \delta A_p \left(V + \frac{v}{2}\right) v$$

Where δ = density of air per unit of mass
Ap = .96 x propeller disc area
V = forward velocity
v = slipstream velocity

Let $$15.\quad \delta A_p = C$$

$$16.\quad RV^2 = C\left(V + \frac{v}{2}\right) v$$

$$17.\quad -\frac{C}{2} v^2 - CV_v + RV^2 = 0$$

$$18.\quad v = \frac{CV \pm \sqrt{C^2V^2 + 2C\,RV^2}}{-C}$$

$$19.\quad v = \pm V \sqrt{1 + \frac{2R}{C}}$$

$$20.\quad V + v = V\sqrt{1 + \frac{2R}{C}}$$

From experimental data we have the following relation

$$21.\quad E = 2950\, K_{yw}$$

Also, by trigonometry

$$22.\quad B = i_t + E - i_w$$

Where E is the angle of downwash from the chord of the main planes and is always positive, and where B is the angular setting of the tail plane relative to the chord of the main planes, (negative if below). i_t is the true incidence of the tail plane.

$$23.\quad L_w = K_{yw} A'V^2$$

$$24.\quad L_t = W - L_w$$

From experimental data

$$25.\quad K_{yt} = .00015\, i_t$$

$$26.\quad K_{yt} = \frac{L_t}{A_t\,[f(V+v)^2 + (1-f)\,V^2]}$$

Where f is the fraction of the tail plane area which is in the slipstream.

Let $$27.\quad [f(V+v)^2 + (1-f)\;V^2] = m$$

Then $$28.\quad i_t = \frac{L_t}{.00015\, A_t\, m}$$

Substituting i_t of 28 and E of 21 in equation 22, we have the proper tail settings B required to balance the aeroplane at all velocities of level flight, i. e., at all angles of incidence of the main planes.

Tabulation of the data is suggested in the following order:

1. i_w	(incidence of wings)
*2. K_{yw}	(corrected for aspect ratio, stagger, etc.)
3. $K_{yw} A'$	(A' from equation 12)
4. K_{xw}	
5. $K_{xw} A'$	
6. R	(equation 13)
7. $R\frac{a_3}{a_2}$	(a_2 and a_3 given)
8. a_1	(From vector diagram for wing cellule alone)
9. $\frac{a_1}{a_2}$	
10. q	$\left(1 + \frac{a_1}{a_2}\right)$
11. V	(equation 11)
12. $\sqrt{\left(1 + 2\frac{R}{C}\right)}$	(equation 13 and 15)
13. V + v	(equation 20)
14. m	(equation 27)
15. L_w	(equation 9)
16. L_t	(equation 24)
17. i_t	(equation 28)
18. E	(equation 21)
19. B	(equation 22)

Suppose that the aeroplane is balanced at a particular angle of incidence of the wings. We must now investigate the reactions of the tail at all incidences of the wings for the particular tail setting B which has been chosen.

Equation 22 will give new values of i_t, since B, E, and i_w are all fixed. The corresponding values of L_t are found by direct proportion, using columns 16 and 17. Knowing the L_t available and the L_t required to balance at any i_w, the differences will give the force tending to produce either diving or stalling moments, and if either these moments or the righting forces are plotted, they will give an indication of the longitudinal stability of the aeroplane.

The tabulation in this case will be

1. i_w	(From previous tabulation)
2. V	(From previous tabulation)
3. E	(From previous tabulation)
4. i_t	(Equation 22)
5. L_{ta}	(Equation 28)
6. L_{tr}	(Same as column 16 in previous tabulation)
7. F_r	(Force required to balance, $(L_{ta} - L_{tr})$)
8. M	($F_r \times a_2$ = righting moment)

Generally, B will be chosen to give balance at an i_w corresponding to cruising speed and it is desired to know what force must be exerted on the control stick to hold the aeroplane horizontal at full power and maximum speed. It is only necessary to determine the high speed from the chart of McCook Field Serial No. 1380.** i_w and F_r are now known and if the latter is divided by the mechanical advantage of the elevator control system the result will be an approximation to the force which the pilot must exert on the stick.

V. Gliding Without Power

Suppose it is required to balance the aeroplane at the angle of best glide. The equations for level flight are modified as follows:

Equation 1′ becomes

$$1''\quad L_w + L_t = W\cos\phi$$

The best angle of glide will be found from

$$\phi = \cot^{-1}\frac{L}{D}$$

where $\frac{L}{D}$ is the assumed maximum for the complete aeroplane.

Equation 11 becomes

$$11'\quad V_1 = \sqrt{\frac{W\cos\phi}{\left[q(K_{yw}A) + R\frac{a_3}{a_2})\right]}}$$

where A is used instead of A′.

R should become $(K_{xw}A + r)$ instead of $(K_{xw}A' + r)$, but it may be assumed that the resistance of the propeller in the glide will make up the difference.

Equations 23, 24 and 27 become

$$23'\quad L_w = K_{yw} AV_1^2 V_1^2$$

$$24'\quad L_t = W\cos\phi - L_w$$

$$27'\quad V_1^2 = m$$

The tabulation is now

1. i_w	
2. K_{yw}	
3. $K_{yw} A$	
6. $R\frac{a_3}{a_2}$	(as for level flight)
7. q	(as for level flight)
8. V_1	(Equation 11′)
9. L_w	(Equation 23′)
10. L_{tr}	(Equation 24′)
11. m	(Equation 27′)
12. i_t	(Equation 28)
13. E	(Equation 21)
14. B	(Equation 22)

We have again the angular settings B for all angles i_w. ϕ will occur at the angle of maximum L/D of the complete aeroplane, and B will be chosen for this i_w to give balance at angle of glide ϕ.

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* A report entitled "Wing Correction Factors" will appear in an early issue of this magazine.—Ed.

** "Airplane Performance and Design Charts," by L. V. Kerber, which will be published soon.—Ed.

Suppose B has been chosen from level flight considerations and it is desired to know the effect of this setting on the stability in a glide ϕ at various angles i_w. The tabulation will be

1 - - 10	(as in previous tabulation)
11. m	(Equation 27′)
12. i_t	(Equation 22)
13. L_{ta}	(Equation 28)
14. F_r	$(L_{ta} - L_{tr})$
15. M	$(F_r \times a_2)$

Column 15 will give a new moment curve which may be compared to the moment curve corresponding to the flight condition for which B has been chosen.

VI. Climbing Flight

The equations for level flight are modified for application to climbing flight, as follows:

Equation 1′ becomes again

$$1''.\ L_w + L_t = W \cos \phi,$$

where ϕ is the assumed best angle of climb, corresponding to an i_w at which we have the maximum L/D of the aeroplane (approximately).

Equation 2′ becomes

$$2''.\ T = RV^2 + W \sin \phi$$

Equation 11 becomes

$$11''\ V = \sqrt{\frac{W \cos \phi + W \dfrac{a_3}{a_2} \sin \phi}{q(K_{yw}A') + R\dfrac{a_3}{a_2}}}$$

where A′ corresponds to the value of $\left(1 + \dfrac{v}{V}\right)$ given for climb as differing from for level flight.

Equation 20 becomes

$$20'\ V + v = V\sqrt{1 + \frac{2R}{C} + \frac{2W \sin \phi}{CV^2}}$$

The tabulation becomes

1 — 10 (as in level flight, except for A′)	
11. $W \dfrac{a_3}{a_2} \sin \phi$	
12. V	(Equation 11″)
13. V + v	(Equation 20′)
14. m	(Equation 27)
15. L_w	(Equation 23′)
16. L_{tr}	(Equation 24′)
17. i_t	(Equation 28)
18. E	(Equation 21)
19. B	(Equation 22)

and we have B required to balance at the assumed angle of incidence of the wings corresponding to best rate of climb. It has been shown how to study the effect of any such setting B, on the stability in level flight and in a glide without power.

VII. At Altitude

At any altitude at which the density relation to the density at the ground is d, the equations for level flight will be modified as follows:

$$8_a\ T = dRV^2$$

$$9_a\ L_w = dK_{yw}A'V^2$$

$$11_a\ V = \sqrt{\frac{w}{d\left[q(K_{yw}A') + R\dfrac{a_3}{a_2}\right]}}$$

Equations 20 and 21 become

$$20_a\ V + v = V\sqrt{1 + \frac{2dR}{C}}$$

$$21_a\ E = 2950dK_{yw}$$

Equations 25 and 28 become

$$25_a\ dK_{yt} = .00015i_t$$

$$28_a\ i_t = \frac{L_t}{.00015A_t\,m\,d}$$

In climbing flight, the following additional modifications may be noted:

Equations 2″, 11″ and 20′ become

$$2''_a\ T = d\,RV^2 + W \sin \phi$$

$$11''_a\ V = \sqrt{\frac{W \cos \phi + W \dfrac{a_3}{a_2} \sin \phi}{d\left[q(K_{yw}A') + R\dfrac{a_3}{a_2}\right]}}$$

$$20'_a\ V + v = V\sqrt{1 + \frac{2Rd}{C} + \frac{2W \sin \phi}{CV^2}}$$

In gliding flight, the additional modification to be noted is that

Equation 11′ becomes

$$11'_a\ V = \sqrt{\frac{W \cos \phi}{d\left[q(K_{yw}A) + R\dfrac{a_3}{a_2}\right]}}$$

VIII. Example

As a typical example to illustrate the method of this report, the DeH-4 ambulance aeroplane will be used; the angular setting with which the aeroplane will be balanced while climbing at 5,000 feet at its best rate of climb will be found; the force on the stick at full power near the ground, and the righting moment curves for the latter case and for gliding without power at best angle of glide, will be investigated.

1. *General Data.*

1. Total weight	3,955 lbs.
2. Total area, wings = A	441 sq. ft.
3. Aspect ratio	7.75
4. Gap/chord	1.06
5. Aerofoil	R.A.F. 15
6. K_{yw} and K_{xw} (corrected)	
7. r	.0433
8. C. G. is 19.5″ aft of leading edge of lower wing.	
9. a_1 (from vector diagram for wing cellule alone).	
10. a_2	17.5 ft.
11. a_3	zero
12. A_1	406 sq. ft.
13. A_2	35 sq. ft.
14. $\left(1 + \dfrac{v}{V}\right)$ for level flight (Eq. 12)	1.20
15. $\left(1 + \dfrac{v}{V}\right)$ for climbing flight (Eq. 12)	1.40
16. A_t	62.6 sq. ft.
17. Diameter of propeller	9′ 2″
18. C	.32
19. f	.50
20. ϕ in glide (Wind Tunnel Report)	7° 40′
21. i_w in glide ϕ (Wind Tunnel Report)	8°
22. ϕ in climb at 5,000 feet. (A.D.M., 55-A)	9°
23. i_w in climb ϕ A.D.M., 55-A)	6°
24. d at 5,000 ft.	.863

2. *Climbing at* 5,000 *ft.*

We will in this case investigate the required B for the incidence of the wings i_w of 6° only. The tabulation of the results is as follows:

1. i_w	6°
2. K_{yw}	.00157
3. A′	475 sq. ft.
4. $K_{yw}A'$	.745
5. K_{xw}	.000088
6. $K_{xw}A'$	.0418
7. R	.085
8. a_1	.46 ft.
9. q	1.026
10. $\dfrac{a_3}{a_2}$	zero
11. $\cos \phi$	.987
12. $W \cos \phi$	3,904 lbs.
13. V	77.0 m.p.h.

14. $\sqrt{1+\frac{2Rd}{C}+\frac{2W\sin\phi}{CV^2}}$	1.445
15. $(V+v)$	111 m.p.h.
16. L_w	3800 lbs.
17. L_t	104 lbs.
18. m	9160
19. i_t	1.4 degrees
20. E	4 degrees
21. B	–0.6 degrees

3. *Level Flight.*

With the determined angle B of —0.6°, forces and moments on the tail will be investigated for level flight conditions near the ground.

The tabulation becomes:

1. i_w	0°	2°	4°	6°	12°
2. K_{yw}	.00056	.00090	.00123	.00157	.00257
3. $K_{yw}A'$	.26	.415	.565	.725	1.19
4. K_{xw}	.000037	.000045	.000062	.000088	.000122
5. $K_{xw}A'$	.0170	.0207	.0286	.0405	.096
6. R	.0603	.0640	.0719	.0838	.1383
7. a_1	—.167	.158	.300	.46	.57
8. q	.9905	1.009	1.017	1.026	1.033
9. $\frac{a_3}{a_2}$	0	0	0	0	0
10. $R\frac{a_3}{a_2}$	0	0	0	0	0
11. V	124	97.2	83	73	56.7
12. $\sqrt{1+\frac{2R}{C}}$	1.173	1.181	1.203	1.232	1.365
13. V + v	145.5	114.7	100.0	90.0	77.5
14. m	18300	11300	8450	6710	4600
15. L_w	3990	3920	3885	3850	3825
16. L_{tr}	—35	35	70	105	130
17. i_{tr}	—.17°	+.28°	+.75°	+1.42°	+2.56°
18. E (8°)	1.62°	2.60°	3.57°	4.55°	7.50°
19. B_r (—.62°)	+1.45°	+.88°	+.32°	—.03°	—1.94°

The above tabulation shows that with the selected B of —0.6°, the aeroplane is balanced at i_w of 8° in level flight. Incidentally, it also lists the various tail settings required for balance throughout the level flight range. Next, for B of —0.6°, will be found the true i_t and L_{ta}, and hence the balancing force required of the tail, the force on the stick at full power, and the tail plane moments for all angles i_w.

1. i_w	0°	2°	4°	6°	12°
2. E	1.62°	2.60°	3.57°	4.55°	7.50°
3. i_t	—2.22°	—1.20°	—0.17°	0.85°	3.90°
4. L_{ta}	—457	—150	—16	63	198
5. L_{tr}	—35	35	70	105	130
6. F_r	322	185	86	42	—68
7. M	—5630	—3230	—1500	—735	1190

The mechanical advantage of the elevator control system on the DH-4 is 2.5 (A.D.M. 470), so that the force on the stick at $i_w = 0°$, which is approximately the angle of level flight for high speed at full power (A.D.M. 489), becomes 130 lbs. This figure is excessive and indicates that B should be increased. It can be shown that with $B = +0.5°$, the force on the stick at high speed would decrease to 80 lbs. In a static test of the DH-4 controls, the stick failed under a load of 170 lbs. It must, however, be remembered that as soon as the elevators are rotated, the load carried by the stabilizer builds up, so that the forces on the stick, as calculated herein, are rather higher than actually.

4. *Gliding without power at angle ø.*

To complete the investigation, we will determine the new tail moments for the case when the slipstream is zero.

The tabulation is as follows:

1. i_w	2°	4°	6°	12°
2. K_{yw}	.00090	.00123	.00157	.00257
3. $K_{yw}A$	.397	.543	.693	1.135
4. q	1.009	1.017	1.026	1.033
5. cos ø	.991	.991	.991	.991
6. $R\frac{a_3}{a_2}$	0	0	0	0
7. V	99	84.3	74.2	57.8
8. L_w	3880	3860	3820	3790
9. L_{tr}	40	60	100	130
10. m	9800	7100	5500	3350
11. B	—0.6°	—0.6°	—0.6°	—0.6°
12. E	2.60°	3.57°	4.55°	7.50°
13. i_t	—1.20°	—0.17°	0,85°	3.90°
14. L_{ta}	—110	—11	44	123
15. F_r	150	77	56	7
16. M	—2620	—1350	—980	—120

It appears that the aeroplane will be balanced in a glide ø at about 12°. Gliding at ø and an incidence of 7° 40′, the force required of the tail to give balance would be about 45 lbs. upward, so that the pilot would be pulling on the stick with a force of about 18 lbs. The degree to which the tail righting moments have decreased is evident from a comparison of the moments in this gliding condition with the moments found for level flight. Just to what extent B would have to be changed to give balance at 7° 40′ could easily be determined as outlined under section V of this report.

IX. Conclusion

Obviously, there are a great number of combinations as to flight conditions at which balance may be required and which it may be desired to investigate when B is fixed. In the main body of the report, one order has been chosen, in the example, another has purposely been selected. It is believed that the effect will be to give the reader an idea of the scope of the application of the method, rather than to confuse him. The present method has further been applied with reasonable results, 1, to find the angular setting of the tail plane on the Verville Racer, to give balance at high speed; 2, to find the area and angular setting of the tail plane on the Lepere Armored Biplane to give proper balance; 3, to investigate the balancing of the DeH-4 with a 300 Hispano-Suiza motor. In these three cases, the theoretical results have been checked by full flight tests.

Collection of the general data required should not be tedious, since the general arrangement and the characteristics of the wing cellule, as well as the location of the c.g., a_2, a_3, A_2, C and f are all known or readily obtainable; values for r, $(1+\frac{v}{V})$, ø and i_w in climb and glide may be assumed with little error. Care should be exercised in constructing the vector diagram for the wing cellule alone. This and the correction of the wing coefficients constitutes the only difficulty, in regard to the time required to prepare the general data.

The results obtained by the application of the present method to the example given, are encouragingly reasonable. It is planned to carry on extensive full flight tests on a particular aeroplane with special reference to this method of determining tail settings and the results of the investigation should prove to be of serious interest.

Climatological Factors Governing the Selection of Air Routes and Flying Fields

(*Continued from page* 369)

mainstay of aviation regardless of the confidence of the aviator in his motor and its ability to carry him safely over all obstacles. The dirigible has inspired us with a confidence in its future as a commercial transport; the aerial mail has definitely stamped the aeroplane as a reliable means of rapid transportation of mail, baggage, and passengers. Great aerial corporations are being organized. They are commercial enterprises, highly capitalized, and founded for the purpose of paying dividends to their stockholders. Dividends depend upon the skillful management of the assets of the company, the reduction of the expense of maintenance, the extension of routes into the most profitable places, the acquisition of the public confidence. Every accident is detrimental to the cause of aviation, not alone because of the direct financial loss, but because it weakens the public confidence. The record of the Aerial Mail Service shows that the weather is responsible for the greatest number of accidents and forced landings.[10] Many of these could be avoided by giving the weather its due consideration. Here is one of the places where the consulting meteorologist is urgently needed.

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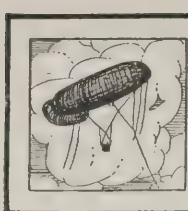
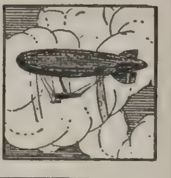
[10] Effect of weather on the Aerial Mail Service. *Monthly Weather Review*, June, 1920, pp. 335-336.



FOREIGN TECHNICAL DIGEST



The Baker Air Sextant

One of the difficulties in using an ordinary sextant in aircraft lies in the uncertainty as to the depression of the visible horizon below the true horizontal.

In order to avoid this uncertain correction to the altitude of the heavenly body observed, the sextant described in this paper has been designed to utilize the part of the horizon directly below the sun and star, and also that part in the opposite azimuth. This is accomplished by the use of two prisms placed above the object glass of the observing telescope. The reflecting faces of the prisms are at right angles to one another and as result the field of view consists of an erect view of the front horizon and an inverted view of the back horizon. The index prism, which is above the two horizon prisms, can be rotated about an axis parallel to the reflecting faces of the horizon prisms; it is used like the index mirror of an ordinary sextant to reflect the image of the sun into the field of view. Light from the sun, after reflection at this prism, passes into the telescope system through a small circular hole drilled centrally through the two horizon prisms. By this index prism the image of the sun is brought down to bisect the space between the two visible horizons, thus dispensing with all corrections for the dip of the horizon and the semi-diameter of the sun. The rotation of the index prism is actuated by a worm and worm wheel, the spindle of the worm having a divided head at the top and a knurled head at the bottom for moving it. Each 10 degrees is marked on the worm wheel, the intermediate degrees and minutes being read on the divided head, the smallest division of which represents 10 minutes. It is possible to read the position of the index prism to two or three minutes. The main part of the telescope is vertical, a reflecting prism being introduced into the eye-piece system so as to enable the observer to look into the instrument in a horizontal direction. *(Instr.-Commander T. Y. Baker, R. N., B. A., Transactions of the Optical Society, Vol. 20, No. 9, 1919.)*

Choice of Density of Admitted Air in the Design of Aviation Motors

The writer in this article defines for each motor:—

1. The altitude of construction Z, to which corresponds a density of charge D_z, which will be very nearly equal to the mean atmospheric density at altitude Z.
2. The limiting altitudes of adaptability, being those between which the correct density of charge D_z can be artificially realized, by throttling down at altitudes $<Z$, and by the use of a compressor at altitudes $>Z$. The lower limit is zero, and the upper H, which is at least equal to Z, and may be greater according to the degree of supercompression.
3. The altitudes of possible use—from zero to the ceiling K. K is always $>H$.

For each machine he defines L to be the maximum height for which the machine is designed for service. A given motor and machine can be used for a given purpose if K is not less than L, and and it will work in optimum conditions (assuming the airscrew able to absorb the full power of the motor at all altitudes) if H is not less than L.

Economy of fuel consumption requires a high value of the compression ratio; the limiting value of this ratio in explosion motors is that which would give rise to auto-ignition. To each value of Z there corresponds a maximum possible value of the compression ratio, ρ_z, which is given by $\rho_z=A(1/D_z)\ {}^{1}/\gamma$, where A is a constant. For fuel economy, therefore, Z must be large and ρ_z must have the corresponding maximum value. An upper limit is set to Z by the consideration of loss of mechanical efficiency due to the increase of cylinder dimensions necessary to obtain the required power at high altitudes. The increase of compression space would involve a larger and heavier piston, which would have to sustain and transmit larger maximum explosive forces; and, in addition, inertia forces and frictional resistances would increase. The consequent loss of mechanical efficiency would, as D_z is diminished, eventually wipe out the increase of thermal efficiency due to the increased compression ratio; engines designed for high altitude Z, and for the maximum corresponding compression ratio, are known as high compression engines.

On the other hand, considerations of lightness of the motor itself require the compression ratio to be low, because the weight of the motor and its various parts will be less, the smaller the maximum pressure of the explosion. For the same power and the same revs. also, a high density D_z enables the cylinder volume to be reduced, with consequent reduction in weight and increase of mechanical efficiency. It follows, therefore, that, provided the density of charge D_z can be maintained by compressor or otherwise at all desired altitudes, a low value of ρ_z and of Z are necessary to secure lightness, fuel consumption being neglected.

The cost of supercharging places a lower limit to Z. Rateau's turbo-compressor appears to be a very efficient form of supercharger. Experiments to date show that in the supercharging of normal motors $(Z=0)$, a value of H of about 4,000 metres is easily realized, and values of 5,000 to 5,500 metres should be possible. Single-wheel compressors do not seem capable of more than doubling the external pressure; this means that Z must not be less than the height at which the mean atmospheric pressure is double that at the height H up to which it is desired to maintain the charge density at the value D_z. It is also found that the over-all efficiency of the turbo-compressor decreases as the altitude increases. These considerations all tend to raise the necessary value of Z.

As shown above, considerations of fuel economy require that the compression ratio, ρ_z, be the maximum permissible for the density D_z. Whatever Z may be, maximum ρ_z means the same pressure at the end of compression, and therefore also practically the same explosion pressure; consequently, all maximum compression motors of the same dimensions are subject to the same maximum loads, and, for the same strength, will have the same weight. The choice of a smaller compression ratio than the maximum will permit a reduction in size, or, alternatively, a reduction in the dimensions of the various parts, and therefore a saving of weight.

The author concludes by pointing out that only much experience in the design of all types of engines for various purposes will enable a designer to solve each new problem satisfactorily, owing to the complex and conflicting nature of the various conditions governing the choice of the density of charge, *i. e.*, of the "altitude of construction" and of the compression ratio. (Jean Villey, *L'Aerophile,* June, 1920. 9 cols.)

The Gordon-Bennett Nieuport

This article describes in detail the Nieuport biplane piloted by Sadi Lecointe in the Gordon-Bennett race.

The machine is very similar to the Nieuport 29-C-1, with certain modifications of the aerofoil for the acquisition of speed. The plane is equipped with a 300 h.p. Hispano, Zenith Carburetor and Oleo spark plug. The Lamblin radiator system is used. *(L'Aerophile,* Oct. 1-15. 4 pp., 2 illus., 1 diagram.)

The Commercial Airship, its Operation and Construction

This is a paper read before the Air Conference in London October 15, by Commander Sir Travor Dawson, managing director of Vickers, Ltd.

It deals comprehensively with the problems involved in the establishment of commercial airship lines and goes in detail into the experience of the German, French and British operating companies.

Some of the other subjects discussed are: The traffic possibilities, size of airship required, safety and dependability, influence of the weather, the development of the mooring tower, airship bases, the need for trained pilots, capital required, insurance, desirability of experiment on a commercial scale; airship construction and development and the possibilities of reducing the cost of construction and operation.

In conclusion Sir Trevor states: "It is very difficult to foresee what developments in aircraft the next ten or even next five years may bring, but imperial interests demand that every endeavor should be stimulated to maintain scientific and practical developments in this country. It would be dangerous to wait and see what other nations will do." *(Flight,* Nov. 11, 1920, 4½ pp.)

Gliders

This article by E. Offermann describes experimental and practical work with gliders from 1908 to 1912 in Germany. *(Flugsport,* Oct. 27, 1920. 9 pp., 10 illus., 5 diagrams.)

Modern Aerial Photography

Recently an immensely interesting achievement was accomplished in aerial photography in England. Two London *Evening News* reporters were assigned to secure photos of a surburban event. The machine was fitted up internally as a photographic dark-room. The pilot landed in a small field near the town and when the photographs were obtained he got off successfully again and flew back to the Croydon Aerodrome, during which time the photographs were developed and printed. This is a novel way of using aircraft, besides being a real, sound commercial undertaking. It seems probable that an aeroplane or aeroplanes will soon be attached to the regular staffs of the more enterprising dailies.

NAVAL and MILITARY AERONAUTICS

Marine Aviation at Santo Domingo

The Marine Aviation Force stationed at Santo Domingo, D. R., is developing air passenger and mail service with highly satisfactory results. Passengers are being taken from one post to another, and mail is being delivered whenever a suitable occasion arises. A satisfactory mail service is in effect between Santo Domingo City and Santiago. Also between Santo Domingo City and San Pedro de Macoris. The mountainous and jungle covered condition of many portions of the Island of Haiti render mail service by air much quicker than by any other means. Furthermore, the unsettled condition of portions of the interior is a source of delay to transportation upon land. It appears that aeroplane mail will be the solution of the problem of delays in communication which have been experienced for a long time in Haiti.

First Day of Bombardment Group Co-Operation with Coast Artillery

A special flight of the First Day Bombardment Group, which has really become a surveillance group, worked with the Coast Artillery at Fort Crockett for two weeks. The flight consisted of Lieutenant Arthur Easterbrook, representing the air officer of the Eighth Corps Area; Lieutenant A. M. Guidera, flight commander; Lieutenant J. M. Woodward, supply officer; Lieutenant C. R. McIver, engineer officer; Lieutenant G. H. Burgess, communications officer; Lieutenant M. J. Plumb, officer in charge of flying, and Lieutenant H. L. Speck, operations officer. The flight had its base on Ellington Field and flew each morning to Fort Crockett, landing on the parade ground. The pilot and observer were thus able, just prior to the shoot, to talk over the work with the officer who was to conduct the fire. The fire was done with 10-inch, 50-caliber disappearing rifles at a range of about 12,000 yards, the target being towed behind a tug. Since there is no way to make an estimate of comparative distances over the water and the officers were not equipped with spotters, it is greatly to their credit that they were, in every case, able to get the shots on the target without wasting ammunition. In each case, from ten to fifteen rounds of sub-caliber were fired prior to using the full service charge. Then followed five to seven rounds of full service trial fire and then salvos of three rounds for fire for improvement. The firing with the full service charge was especially accurate and there was practically no correction necessary for deflection. A great deal of credit is due to Lieutenant Burgess for the fact that there was not a single instance of radio failure. Each ship was fitted with dual generators and a knife switch so that if one generator burned out the other could be cut in immediately. Twelve enlisted mechanics and one truck with radio equipment were stationed at Ellington Field during this work.

Air Service Observation School Opens

The Air Service Observation School at Post Field, Fort Sill, Okla., in charge of Captain John Howry, opened Monday. Two separate courses are given—a refresher course for newly-arrived officers and a course to train cadets as Observation Pilots. The refresher course is merely a review of the fundamentals of observation. Due to the fact that most of the officers have recently been commissioned from civil life, they are somewhat rusty on observation work, and this course will indeed be a great help to bring them back in form. They are scheduled to go to the School of Fire at Fort Sill, Okla., beginning about January 1, 1921, after which they will be used in the Observation School as instructors.

Experiments in Apparatus for Handling and Manufacture of Hydrogen Gas

The Experimental Station at Fort Omaha is conducting experiments in apparatus for the handling and manufacture of hydrogen gas for balloons. This work is of importance because, with the coming of large dirigibles and the general expansion of the lighter-than-air branch of the service, great quantities of this gas at a reasonable price are necessary. Proper equipment for handling the gas insures safety and economy in its use.

The gas used in balloons is frequently stored in cylinders under the high pressure of two thousand pounds per square inch. Under this high pressure it is difficult to get valves to work smoothly and easily and still be tight in service, preventing gas losses from leakage. At this experimental station such valves have recently been designed. Like other good pieces of mechanism, they are comparatively simple in design, and they can be made much more cheaply than the more complicated valves previously in use. In addition, they have been especially designed to meet Air Service demands, which require a valve that will vent a cylinder rapidly without freezing up. The standard valve now in use requires seven minutes to completely vent a cylinder, while the present valve developed at Fort Omaha will accomplish this in from twenty-five to fifty seconds.

Fort Omaha is being equipped with a machine shop which will be suitable for the manufacture on the working scale of much of the machinery being designed there. One of the first pieces of apparatus which will be manufactured in this shop is a hydrogen gas generator known as a silicol generator because of the fact that, in its operation, the hydrogen is produced by mixing ferro-silicon and caustic soda. In this generator are embodied the results of wide experience gained in operation of this type of equipment during the war. Such improvements have been made that the new generator will produce almost twice as much hydrogen from a given quantity of materials as did the older types. At the same time, a generator of a given size will have almost double the capacity of former machines. These improvements will result in great economies and in the production of a machine highly specialized and designed to meet the exacting demands of military field service.

Furthermore, there is ready for test at this station an improved type of electrolytic cell for the production of hydrogen gas. The design of apparatus of this kind requires highly developed technical skill. This particular apparatus, like the silicol generators already developed, is expected to produce many times more gas for a unit of given size than does apparatus of the same type now in use. In present apparatus a good deal of trouble is experienced with insulation; in the newer design this will probably be avoided altogether, or at least greatly reduced. The decomposition of water by the electric current is a long-established process but, like most similar processes, is susceptible of a good deal of development in the hands of trained engineers. It is an indication of the general progressiveness of the Omaha station, and the Air Service in general, that technical problems of this kind are being undertaken and that the highest development and the greatest efficiency are the things constantly sought after.

Test Flight of Smallest Aeroplane in the Service

The Messenger aeroplane was flown in its initial flight November 1 by Lieutenant John A. Macready of the Flight Test Branch, Dayton, Ohio. This plane is the smallest now in the service, and is equipped with a three-cylinder air-cooled radial engine of sixty-horsepower. The plane responded very well to the controls, and was reported by the pilot to be very pleasant and easy to fly. The high speed was ninety-six miles per hour, which is considered very remarkable for such a small plane with an engine of such low horsepower.

Three hundred and fifty-four flights were flown in heavier-than-air craft, for a total of three hundred and forty-nine hours and five minutes.

Experiments were conducted on lights for night flying which is to be incorporated in the training course on Thursday night, November 4, 1920. A flight was made in F-5-L No. 4009, Lieut. A. P. Snoddy, U. S. N. R. F., Lieut. (j. g.) Lambert Hewitt, U. S. N. R. F., and Ensign M. R. Cook (T), U. S. N. An automobile spotlight was placed on the bow; two others were placed, one on each side of each pilot, these being adjustable. Conditions were just right, the night being very dark (no moon) and the water smooth. It was found that the light from the spotlight was not strong enough, and flares will be used on the next flight.

Squadron I (N-9's)—Flying time, 57:15; average number of planes available, 14.

Squadron II (HS-2's) — Flying time, 93:15; average number of planes available, 6.

Squadron III (H-16, F-5 L's)—Flying time, 91:50; average number of planes available, 6.

Squadron IV (N-9's, HS-2's, R-6 L's)—Flying time, 106:45; average number of planes available, 9.

FOREIGN NEWS

To Reconnoitre Mount Everest

Reading a paper before the Royal Geographical Society on November 8 on the proposed attempt to climb Mount Everest, Brig.-Gen. the Hon. Charles Bruce said it was hoped that the Government of India would place aeroplanes, for reconnaissance purposes, at the disposal of the next party to make the attempt. Reconnaissance, camping grounds, and the establishment of depôts could not be the only difficulties. Teams would have to be trained and men tested. The Alpine Club members were to organize and carry out the actual climbing of the mountain, and the Geographical Society would undertake the scientific side of the work, in which they hoped for the co-operation of the Survey of India.

Whale-Spotting from the Air

Major Honnet, of Air Flights, Ltd., has recently returned from England to East London with three Avros, which he has assembled in conjunction with Mr. Basil Runnert of the same company. Major Honnet hopes to be able to interest whaling companies in the use of aircraft for whale-spotting.

Filming the Victoria Falls from the Air

Messrs. Rutherford and English have been filming the Victoria Falls from their Avro biplane "Rhodesia." In spite of the difficulties of the task, principally due to the dense bush, emergency landing-grounds being absolutely non-existant, the falls were successfully "shot," which tends to prove that practical commercial flying in Rhodesia is a sound proposition.

Aerial Forestry

A recent expedition carried out by the Canadian Air Board to Lake Timiskaming was an unqualified success, and as a result forestry experts and entomologists are loud in their praise of the possibilities and future of aviation. Col. Leckie flew some specialists up the Ottawa River to North Bay and then on to Haileybury.

On approaching the latter spot the entomologist suddenly began to gesticulate wildly and the pilot thought for a moment that he was taking leave of his senses. It appeared, however, that he had spotted the "spruce bud worm" disease from the air.

The forester said that in eight hours' flying he had been able to sketch in, from the air, on his map complete details of the forest in forty-two townships, showing the different types of growth, burned over, cut and diseased areas, etc., a work which could not have been done by many parties in a single season.

The Australian Aircraft & Engineering Co., Ltd.

The Australian Aircraft and Engineering Co., Ltd., have during the summer months done considerable business both from the flying and selling point of view. The company have secured more sales than any other firm in Australia, this being attributed to the fact that they are in a position to build machines on the spot. Their total sales since they commenced operations at the beginning of the year are:—

One Avro 504K (110-h.p. Le Rhône) to the Northern Queensland Graziers' Association.

Two Avro 504Ks (130-h.p. Clêrget) to the A.A.E. Co., Ltd., for demonstration purposes.

One Avro 504K (110-h.p. Le Rhône) to A. V. Roe and Co., for demonstration purposes.

One Avro 504K (130-h.p. Clêrget) to Mr. Tatton, of Hastings, N. Z., for passenger-carrying.

One Avro 504K (100-h.p. Sunbeam "Dyak") to Mr. P. Heyde, of Nimitybelle, N. S. W.

One Avro 504K (100-h.p. Sunbeam "Dyak") to Mr. Leresche, of Walgett.

Two Avro 504Ks (100-h.p. Sunbeam "Dyak") to the Auto Aero Services, Ltd., Queensland.

The Avro bought by the Queensland Northern Graziers' Association, which was an imported machine, was delivered on August 13th by Lieut. Adair from Sydney to Brisbane, a total distance of 500 miles, at an average air-speed of nearly 100 m.p.h. A non-stop flight from Newcastle to Grafton of 240 miles during the course of the delivery flight constitutes an Australian record for rotary engines. The purchasers have extensive properties in North Queensland, and the machine will be used by the managers of the Association on station inspections and visits to and from Brisbane. The two machines ordered by the Queensland Auto and Aero Services, Ltd., will be used between the railheads of a certain part of Queensland.

A machine belonging to the A. A. and E. Co., Ltd., has been operating in Brisbane on propaganda work, which resulted in numerous inquiries and the sales mentioned above.

Aviation in Burma

It is reported in Burma that Aeroad (Burma), Limited, have received orders for five new aeroplanes from well-to-do young Burmans. It is hoped to start a daily aerial service between Rangoon and Bombay via Calcutta in the near future.

British Aerial Troopships

The British Government's experiments with aerial troopships at an aerodrome near London have proved a success, it was learned recently. They were conducted with great secrecy under the direction of Secretary of War Winston Churchill. The aerial troopships are aeroplanes of unprecedented size, built by the Vickers, Limited, the company which constructed the Vickers Vimy, the aeroplane in which the late Capt. Sir John Alcock and Sir John Whitten Brown crossed the Atlantic Ocean. The Air Ministry refused to permit any indication to be made of the description of the super-aeroplane with which the experiments were made, or the number of men it carried. According to reports the Air Ministry planned aeroplanes big enough to carry light artillery as well as troops.

Mauritian Service

Irregular arrivals of mail boats from Europe via Madagascar and Reunion and the shortage of coastal shipping has induced a number of Mauritian traders to finance a company for the inauguration of an aerial service to connect Mauritius with Madagascar and Reunion, on the one hand, and with Seychelles, Rodriques, and the Oil Islands, on the other. The moving spirit in the new venture is Mr. Anthony Colin.

Glasgow to London by Air

Scotland has reason to be proud of her association with the latest advance in commercial flying says the *Greenock Telegraph*. The commencement of the Beardmore air service between Glasgow and London is the most striking development since the recent conference on civil aviation. Though undertaken at a period of the year when airmen have to encounter their worst enemies—mist and fog—the inaugural trip proved a striking success. The 450 miles from Renfrew aerodrome to Cricklewood were covered in four and a half hours.

Maintaining an average speed of a hundred miles an hour the machine beat an express train from Glasgow to the Metropolis by nearly five hours. The advantages to commercial concerns are obvious. By establishing a swift mail service by air, replies to letters received in Glasgow in the morning can be conveyed south in time for delivery the same day. This method of mail transport was discussed at the air conference, and the Government were urged to give substantial aid to such enterprises. The success of the Beardmore experiment raises the question again in a practical and pressing form. Germany is forging ahead in this direction, and we cannot afford to lag behind the Fatherland or any other country in developing our resources for air travel.

The Government and Civil Aviation

Speaking at a recent meeting of the Air League Major General Seeley, M.P., Under Secretary of State for Air, said that he believed the Government would come forward to help commercial aviation.

"Our Empire which has hitherto depended on sea-power must now depend on air-power too. Without both the Empire cannot survive" he added.

At the same meeting Lieut.-Colonel Moore-Brabazon, M.P., said aviation is the one power of the future and can only be expanded quickly by fostering the civil side.

Aviation in the Argentine

According to advices received by Handley Page, Ltd., the Argentine Government has sanctioned the establishment of an important air mail service between Bahia Blanca and Rio Gallegos, the distance to be covered being about 1,500 miles. Four main aerodromes are being established at Bahia Blanca, San Antonio Oeste, Trelew, Comodoro Rivadavia with intermediate landing places at Patagones. Two emergency landing places have been arranged for, one between San Antonio and Trelew, the other between Trelew and Comodoro Rivadavia. The headquarters of the Air Services will be situated at Trelew, in the vicinity of Puerto Madrin, which is the most convenient port for the transport of material. Fully equipped repairing shops will be erected at all the main aerodromes and emergency outfits will be available in connection with the landing grounds.

Much enthusiasm in the Argentine has been shown in aviation since the demonstration school at El Palomar was established by Handley Page, Ltd., in December last. Many pilots have been trained there for Government Service as well as private owners who have purchased aeroplanes for the establishment of local services. A popular feature of the School has been the periodical demonstrations which have taken place there and also the many excursion flights.

German Views on Amphibians

German aviation experts are expressing their views freely in regard to amphibian aircraft, writes the Handley Page Berlin correspondent and are sceptical as to the practicability of using the Thames in the centre of London, as the starting and landing place of these huge flying machines. They point out the dangers and difficulties which in their opinion must inevitably arise on rivers flowing through the center of such cities as London and Paris where the shipping traffic is already sufficiently congested. Another objection raised by German aeronautical engineers is that the useful load and the earning power of the amphibian are less than that of the aeroplane.

Handley Page Air Services

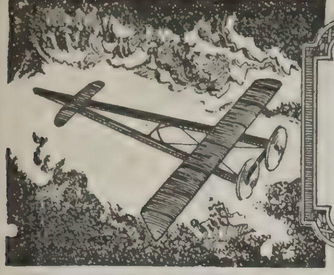
Owing to the inadequate provision of suitable ground organization for air navigation under winter conditions prevailing over Holland and the Belgian Coast it has been found necessary to suspend the direct air service to Amsterdam. Meanwhile, there is a rapid service to Amsterdam via Brussels. Passengers leaving Cricklewood by air at 12:30 P.M. are able to secure the railway connection from Brussels to Holland reaching Rotterdam, The Hague, and Amsterdam on the same evening. Arrangements are being made for the conveyance of freight by the same route.

Germany Refuses to Deliver More Zeppelins

From a message to hand from Berlin, it appears that the demand of the Ambassadors' Conference for the surrender of two further Zeppelins —The "Bodensee" and the "Nordstern"—as a compensation for the two destroyed German airships is being resisted, as is also the claim for a monetary compensation for the other destroyed airships. In pleading that these demands are quite unjustified, Germany tries to make out that all Entente claims on Germany in respect of alleged violations of the terms of the Armistice have been settled under the Scapa Flow protocol.

German Services Suspended

It has been decided that the German aerial services connecting Amsterdam, Bremen, Hamburg and Copenhagen and Berlin, Warnemunde, Malmoe and Copenhagen shall be suspended during the winter months. The present intention is to resume these services in March next. The service between Berlin and Bremen is to be maintained during the winter.



ELEMENTARY AERONAUTICS
and
MODEL NOTES

Details for Building a 26-Inch Scale Model of the S.E. 5 Scout

(*Continued from November 29 Issue*)

The large outline drawing given on the Elementary Aeronautics Page last week, together with the present detailed instructions, will enable model builders to proceed to build the flying S.E.-5 model.

Four S.E.-5 Scouts were entered in the Pulitzer Trophy Race on Thanksgiving Day, and the trim lines and fine performance caused a good deal of admiration from the spectators. The way these little Scouts performed should prove encouraging to those interested in building scale models that imitate, as close as possible, the characteristics of the full-sized plane they are patterned after.

Below is a list of the general measurements giving the model builder an idea of the proportions.

Dimensions

Span (upper and lower wings)	26 "
Length overall	20½"
Height	9 "
Wing Chord	4¾"
Gap between wings	4⅛"
Propeller	8½"
Wheels	2 "

Fuselage

The fuselage consists of the usual four longerons made of one-eighth square spruce and braced with cross members of the same size. After cutting longerons to the right size, they are bent at the points shown on the drawing by holding them over the steam from a kettle. In attaching the cross members holes should first be drilled with a No. 60 drill. It is advisable to use hot glue and small nails.

The top longeron is curved in the plan view only but from the side is horizontal. The lower longeron is horizontal from the radiator to the rear wing beam and after a slight upper bend runs straight back to the rudder. It will be seen that, with the exception of the curves near the pilot's seat, the longerons are straight. The cowling or top covering from the radiator to the rear of the pilot's seat may be made of light gauge aluminum. From the pilot's seat to the tail, light curved formers can be made of thin spruce or balsa wood, with light bamboo strips to form the turtle deck. A balsa wood stream line head-rest is glued in place at the rear of the pilot's seat.

The motor-stick is 10¼" long. This is made of ⅛" x¼" spruce with an aluminum propeller hanger at the front end and a hook for the rubber at the rear. A ball bearing propeller shaft may be used. The motor-stick unit is attached to the under side of the first two cross members between the upper longerons. It is not advisable to fasten the motor-stick at any point in back of the model because when the rubbers are wound up the motor-stick will twist and if fastened at the rear will cause the tail to twist. This, of course, would tend to make the machine spiral and probably crash before it even has a chance to get off the ground.

Wings

The first step is to construct the ribs and to drill them for the spars. After holes are drilled they should be cut out with square corners to admit the wing beams. Although it is a little more difficult to make the square holes, it gives a more satisfactory job than round wing beams would, for with the round beams wings are very difficult to keep from warping. The ribs are spaced 1⅝" apart. Spars, ⅛" x ¼". Rear wing beams should be a little less than ¼" high. The dihedral is made in the beams by steaming them before the ribs are put in place. The lower wing should be in one piece and may be attached to the upper side of the bottom longeron. To assist in the balancing, it is well to attach the wings to the body by means of elastic so that they may be shifted for balance.

The ailerons may be made separate but they should be held rigidly in place, for any disarrangement of them would cause the model to become unmanageable during flight.

The struts between wings are made of ⅛" round reed. They are fastened to the wings by means of ⅛" holes drilled in the wing spars. These holes must be drilled at a slight angle because of the stagger. If desired, light tube fittings can be attached to the wings for the struts so as to avoid drilling the holes.

Light bamboo paper or China silk makes the best covering for the wings. The covering is stretched tightly over the surface with edges glued to the trailing edge of the wing. When it is dry a coating of dope should be applied. The dope can be made of banana oil in which transparent celluloid is dissolved.

Tail

For ease of construction the elevator and stabilizer are made in one piece. The same is true, also, of the vertical fin and rudder.

The principal members of the stabilizer consist of two beams, the forward one ⅛"x3/16" and the rear one ⅛" square. The light bamboo ribs are put into place on either side of the spars, making the stabilizer and elevators streamline in shape. The outline is made of ⅛" or 1/16" round reed bound with silk thread and glued at the ribs and spars. Attachment to the body is made by fastening to the under side of the top longerons.

The fin and rudder are made of a single strip of ⅛" reed bent over a candle flame or steam. Two ribs are needed to give these surfaces support for the covering. Underneath the body is a fin and tail skid formed of ⅛" reed. Both these surfaces are covered with the same fabric as used on the wings.

It will be noted that the SE-5 has an unusual tail skid arrangement. In actual practice the skid consists of a pair of steel springs covered over with an arrangement of aluminum plates. The rudder is attached to the tail skid post in such a manner that the pilot turns both when moving his rudder bar.

The surfaces of the tail group should be covered similar to the wings. This also applies to fuselage covering.

Landing Gear

The landing gear is composed of a pair of "Vs" of ⅛" reed. Open ends can be fastened to the fuselage by silk thread or light steel wire. The lower ends of the "V" are held apart by a 1/16" wire rod fastened to the lower end of the "V." The axle consists of 1/16" steel or brass rod bound to the chassis by means of rubber bands. Preferably the axle should be threaded for small nuts so that the wheels can be fastened on properly. Wheels are slightly greater than two inches in diameter, but two-inch wheels will do. The drawing shows the type of wheels used on the SE-5. It will be noted that the spokes on the inside of the wheels are vertical and the disc appears on the outside of the wheel only. Wheels may be made of wood with grooves cut to accommodate the tires, which may be made of solid rubber.

Some of the model companies advertise ready-made wheels which add a lot to the appearance of the model, and if builders have not the facilities for turning out the wheels the best plan is to purchase them.

Propeller

The propeller is 8½" or 9" in diameter. It can be cut from a block of white pine ⅞"x1⅛". (Directions for carving propellers have been given in previous issues of Aerial Age.)

General Directions

First see that the completed aeroplane balances at a point about 2½" from the leading edge of the top wing. From this location the weight of the model can be varied. If the plane shows a tendency to rise too quickly, the wings must be shifted so the weight comes a little more forward and vice versa.

It is a good practice to use glycerine on the rubber. Do not wind the rubber up fully when it is first used but gradually increase the number of winds given to it. This will add to the life of the rubber.

If it is found that the model performs satisfactorily, it is possible to obtain longer flights by increasing the length of the motor stick and lengthening the rubber. This, of course, necessitates a corresponding movement of the main wings toward the tail.

Aeronitis

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

There Was a Reason

Bridges—I wonder how Henpeck came to buy an aeroplane. Do you know?

Rivers—Yes. He said he thought maybe his wife wouldn't be so free to find fault with him after she saw how much trouble he was having with his machine.

She Understood

Aviator (home from the war on leave)—And then when you are up pretty high—three or four miles, say—and you look down, it is stupendous, awful. A great height is a fearful thing, I can tell you.

Lady (feelingly)—Yes, I can sympathize with you, poor boy. I feel just that way myself when I'm on top of a stepladder.—*Tiger.*

Fame

A Long Island teacher was recounting the story of Red Riding Hood. After describing the woods and the wild animals that flourished therein, she added:

"Suddenly Red Riding Hood heard a great noise. She turned about, and what do you suppose she saw standing there, gazing at her and showing all its sharp, white teeth?"

"Teddy Roosevelt!" volunteered one of the boys.—*New York Times.*

Pretty Lively

Doctor—Well, and how did you find yourself this morning?

Patient—Oh, I just opened my eyes and there I was.—*The Purple Cow.*

Motor Expert—Is your new motor car a good hill climber?

"Fine," replied Mr. Chuggins. "I only wish it would draw the line at hills. Sometimes it wants to try a tree or a telegraph pole."

No Interruption

Doctor—You will have to give up all mental work for a few weeks.

Patient—But, doctor, in that event my income would cease. I earn my living by writing poems for the magazines.

Doctor—Oh, you can keep right on at that.—*Indianapolis Star.*

Late

Porter (knocking on door)—It's nine o'clock, sir!

Voice of irate gentleman within—Why did'nt you tell me before.

At the Concert

Signor Palmoleev (singing Palestrina's Opus 169.4)—Come, Josephine, in my flying machine, going up she goes, up she goes . . .

Frau Z.—Shut off your motor, Palmy; your voice is out of sight already.

Why

"Why do you work so hard?"

"I'm too nervous to steal."—*Puppet.*

Luck

"I see you have a horseshoe over the door," said the Pessimist, entering the hangar. "Has it ever brought any luck?"

"Well, it has tumbled down half a dozen times, and never killed anybody yet," replied the Optimist.

Prayer Needed

Minister (to sick student)—I take a friendly interest in you, my boy, because I have two sons in the university myself; one taking engineering and the other aeronautics. Is there anything I can do?

Sick Student—You might pray for the one taking engineering.

Just Luck

"How did you contrive to convince your wife you could not afford to own an aeroplane?"

"Pure luck on my part. She wanted to have an old dress cleaned and bought a gallon of gasoline."

Around, All Right

Teacher—Who can tell me the meaning of a "round-robin?"

Bright Boy—Please, miss, it's what that burglar was doin' last night when they nabbed him.—*Boston Transcript.*

Different with the Operators

The following conversation took place in the office of a large motor concern:

"Very few typewriters receive the care and attention that should be bestowed on them," remarked the Old Fogy.

"You must be talking about the machines, aren't you?" asked the Grouch.—*Cincinnati Enquirer.*

"Is that Eddie Jones, the balloonist, with an automobile?"

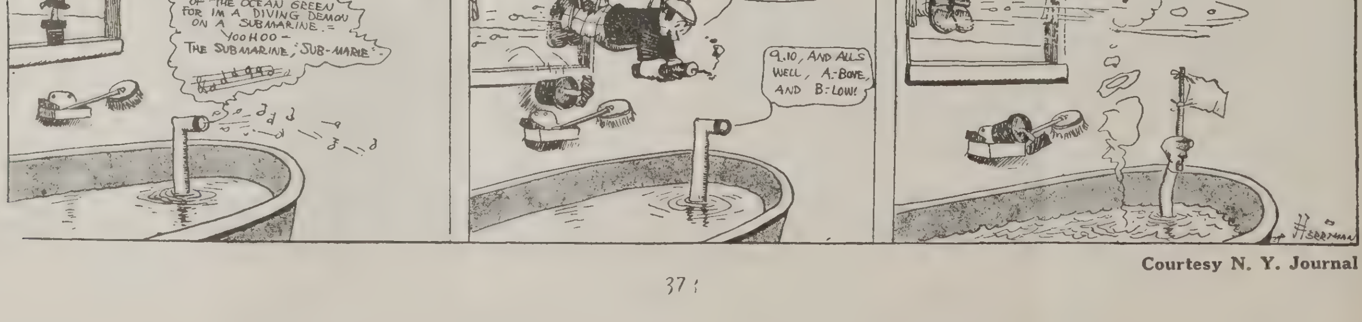
"I never thought he would succeed."

"He succeeded to a million dollars from his grandmother."

Within the Law

Rural Constable—Now, then, come out o' that. Bathing's not allowed e'er after 8 a. m.!

Hydroaeroplanist in the Water—Excuse me, sergeant, I'm not bathing; I'm only drowning.


OH, I'M 'BARON BEAN' SO LISSOME, AND LEAN, AS GOOD A MAN AS Y'EVER SEEN' ON THE TOSSING TIDE OF THE OCEAN GREEN FOR I'M A DIVING DEMON ON A SUBMARINE. = YOOHOO - THE SUBMARINE, SUB-MARIE
THIS GIANT FIRE-CRACKER OUGHT TO BRING THAT SCOUNDREL TO THE SURFACE. DAGNAB HIM !!
9.10, AND ALLS WELL, A-BOVE, AND B-LOW!
Herrman

Courtesy N. Y. Journal

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AEA
Engineering

AERIAL AGE WEEKLY

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Ready to Make a Parachute Jump

National Advisory Committee Presents Annual Report to Congress

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The RUGGLES ORIENTATOR

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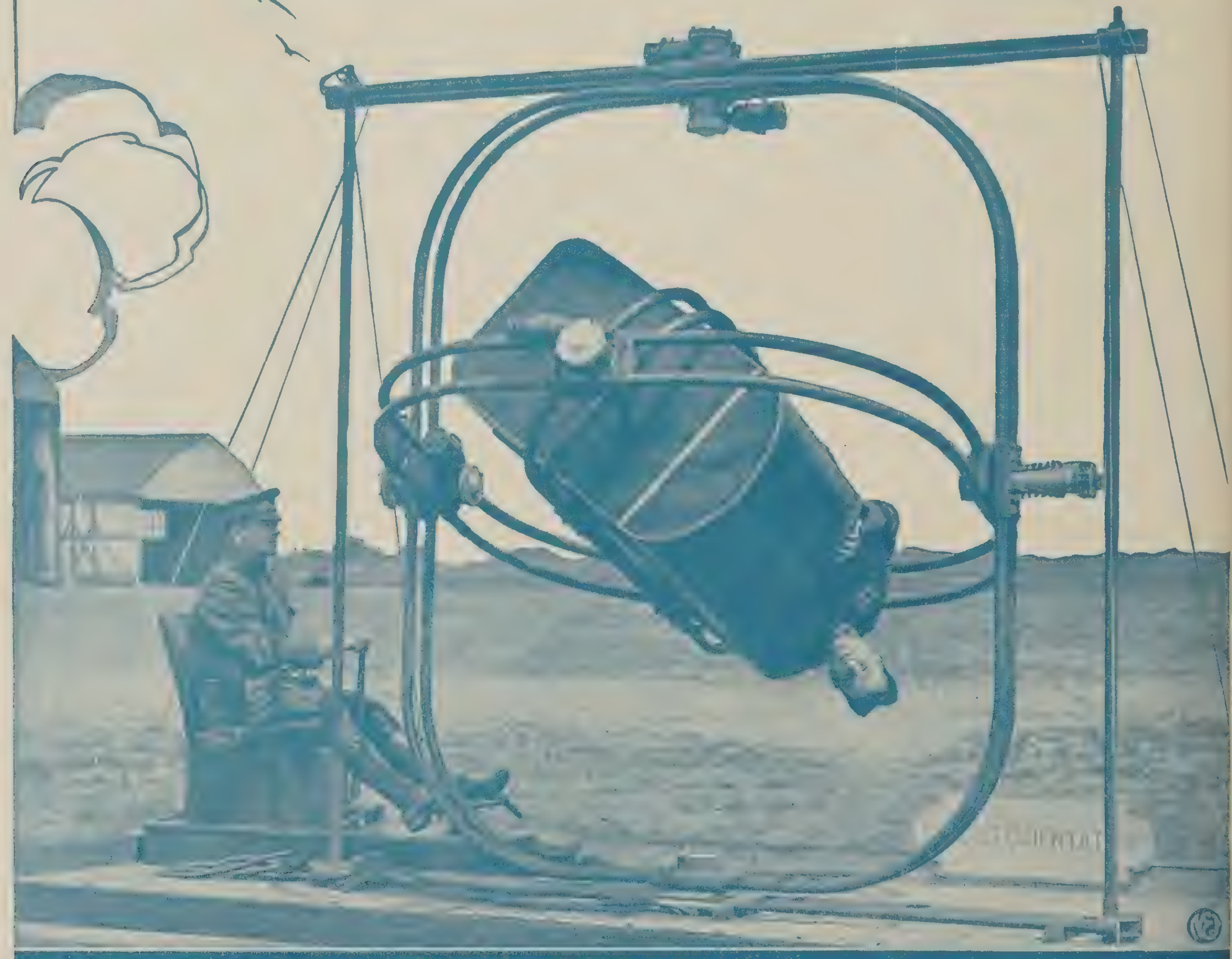
This invention **exclusively built, owned, and used by the Government during the war**, is now to become available for use in the civilian field. Some of the most successful and prominent flying instructors in America are becoming identified with this enterprise.



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NATIONAL ADVISORY COMMITTEE PRESENTS ANNUAL REPORT TO CONGRESS

DR. CHARLES D. WALCOTT, chairman of the National Advisory Committee for Aeronautics, submitted his annual report to Congress on December 6th, and in the letter of submittal, President Wilson states:

"The attention of Congress is invited to the recommendation of the National Advisory Committee for Aeronautics for the establishment of a Bureau of Aeronautics in the Department of Commerce for the regulation and encouragement of commercial aviation. The national aviation policy as formulated by the National Advisory Committee for Aeronautics and the constructive recommendations therein set forth for the consideration of the Congress have the hearty approval of the departments concerned as well as myself."

The report deals exhaustively with the work of the committee during the last year and outlines the program for the next year. Two sections are of particular interest.

Organization of Governmental Activities in Aeronautics.

"During the past year the committee has on numerous occasions given consideration to the subject of organization of governmental activities in aeronautics. A number of bills had been introduced in Congress providing widely differing solutions of the question, and each of these bills was discussed by the committee. After the adjournment of Congress and throughout the summer and fall of 1920 the committee endeavored to coordinate the views of the various governmental agencies interested, and to develop a tentative draft of legislation giving definite expression to the agreements reached. In its consideration of each of the measures introduced the committee was guided by an intimate knowledge of the problems peculiar to the military and naval air services, by the necessity of providing for, and reckoning with, a healthy development of civil aviation, and by broad general considerations of sound governmental policy in regard to matters of organization and administration. Of all the bills analyzed by the committee, two were selected for more earnest consideration, and in each case this has led to agreement upon amendments which will, in the committee's judgment, render either measure, if enacted into law, operative with a minimum of friction, confusion or waste, at the same time utilizing existing agencies to the best interests of good administration. An analysis of the two bills referred to, as modified by the committee, follows:

"House bill 14061 was introduced into the House of Representatives by Mr. Kahn May 13, 1920. With the modifications recommended by the National Advisory Committee for Aeronautics, it provides for the establishment of a Bureau of Aeronautics in the Department of Commerce, in charge of a Commissioner of Air Navigation, whose duties will comprise the licensing of aircraft, pilots, and airdromes, the designation of flying routes, cooperation with the States and municipalities in the laying out of landing fields, and, in general, the promotion of all matters looking to the advancement of commercial aviation. The bill provides also that all rules and regulations governing air navigation, licenses, etc., shall be formulated by the Commissioner of Air Navigation, who shall submit the same to the National Advisory Committee for Aeronautics for consideration, criticism, and recommendation to the Secretary of Commerce, who, if the same meet with his approval, shall formally promulgate the same. The bill provides further that the Commissioner of Air Navigation shall be appointed a member of the National Advisory Committee for Aeronautics, and shall seek the approval of the committee in certain matters, such as the laying out of flying routes, etc., which may hold a vital interest for other departments of the Government. The committee believes that all such extensive plans should be carefully considered with a view to serving the national interests as far as possible; that the Commissioner of Air Navigation should have the benefit of the counsel and advice of the other governmental agencies concerned; and that the method proposed in this bill would be practicable and effective.

"House bill 14137 was introduced in the House of Representatives by Mr. Hicks May 19, 1920. With the modifications recommended by the National Advisory Committee for Aeronautics, it makes substantially the same provisions for the regulation and development of air navigation as the modified bill, H. R. 14061, described above, with several additions, viz.: That the various departments of the Government shall prepare programs for experimental research or development work in aeronautics, and for the purchase or construction of aircraft, engines, accessories, and hangars, and the acquisition of land for purposes in connection with aviation, and shall submit such programs to the National Advisory Committee for Aeronautics for consideration and recommendation before contracts are made or orders are placed for same; that for the purpose of preliminary correlation of estimates the various departments shall submit their estimates for all aviation purposes to the National Advisory Committee for Aeronautics for consideration and recommendation by the committee before the estimates are submitted to Congress, the comments and recommendations of the Advisory Committee to be transmitted to Congress along with the estimates.

"The committee has been actuated in its suggested revision of these bills by a desire to produce practicable workable plans for improving the existing situation. The committee believes that the Hicks bill as modified is responsive to that sentiment in Congress which has sought to prevent duplication of expenditures and effort in the military and naval air services. The committee is not wholly convinced that the necessity for such legislation exists at the present time, nor that the method proposed would have the desired result. On the other hand, the committee is unanimous in supporting the Kahn bill as modified. The most urgent need at this time is the development of commercial aviation under Federal regulation. There has been some objection to placing the regulation of air navigation under the Department of Commerce, but the National Advisory Committee for Aeronautics believes it unnecessary and unwise to create another independent Government establishment for the exercise of such functions, and that by making the Commissioner of Air Navigation a member of the National Advisory Committee for Aeronautics, and requiring him to submit his plans to the committee, he can not fail to be guided in his actions by considerations of paramount national interests. The text of the two bills referred to, as modified by the National Advisory Committee for Aeronautics, have already been printed in AERIAL AGE.

A National Aviation Policy.

"Aviation activities during the war were concentrated on the development and production of military aircraft. The selection of the landing fields that were established was necessarily guided by military considerations. The close of the war found us with an aeronautic industry at the stage of quantity production, a large amount of aircraft material on hand, a large number of trained flyers, and a few scattered landing fields. In brief, all this constituted the national inheritance from the investment of hundreds of millions of dollars for the hurried development of military aviation during the war. In the two years that have elapsed since the armistice a good proportion of the aircraft material has become obsolete. A majority of the technical personnel and trained flyers have returned to civil life and to pursuits not connected with aviation. The great aircraft industry has almost disappeared, and some of the landing fields have been surrendered. Those that have been retained really represent one of the most valuable physical assets salvaged from our aircraft expenditures.

"As a nation we must seek to realize clearly the lessons of the war and to profit by them. Our efforts in the development of a military air force and the organization of an aircraft industry during the war were remarkable accomplishments in themselves, but the handicap of a negligible industry at the outbreak of the war and the general lack of technical knowledge were too great to be satisfactorily overcome in a short time, regardless of the money available. It is now our clear duty to take to heart the lessons and mistakes of the war period and to shape a national aviation policy that will be productive of the greatest possible structural development consistent with prudent economy.

"The Government agencies actively concerned with the use of aviation at the present time are the Army Air Service, the Naval Air Service, and the Postal Air Service. Other agencies such as the Geological Survey, the Coast and Geodetic Survey, the Forest Service, etc., have more or less need for the use of aircraft in their work. The National Advisory Committee for Aeronautics is concerned not so much with the promotion of the uses of aviation as with the scientific study of the problems involved and the technical development of the art for the benefit of governmental agencies and of the public generally, but the committee believes that the use of aircraft by the various governmental agencies should be encouraged where its efficient use is practicable; also that the general development of aviation for all purposes should be encouraged by the National Government. The faithful performance of our national duties in these respects becomes compelling from considerations of wise military preparedness.

"In time of war aviation will probably be the first arm of offense and defense to come into action. For this there must be an established industry and a trained and active air service. Aerial supremacy at the outset of hostilities would be a tremendous military advantage. Ultimate victory would unquestionably incline to the side that could establish and maintain supremacy in the air. Huge expenditures of money in time of danger and frantic efforts to train personnel and to develop hastily an aircraft industry from almost nothing will not do. There must be wise preparedness; there must be in healthy existence at least a nucleus of an industry capable of adequate expansion; there must exist civil and commercial aeronautical activities in all parts of the country which would be the main support of the industry in time of peace. In pure self-defense the Government must encourage the development of commercial aviation. The alternative proposition is the creation and maintenance of a powerful standing military air service relatively self-reliant in time of war. We can not, however, afford the expense which such a policy would entail, and there would be no advantage in time of peace from such expenditures comparable in any way to the advantages to be gained from the support of civil aviation. We should maintain an active air service in time of peace, which should possess inherent strength and be something more than a mere nucleus for expansion in time of war. In the final analysis, however, we must depend upon civil aviation to furnish a military reserve force. The remarkable accomplishments of our Motor Transport Service during the war were only made possible by the healthy condition of our automobile industry. The problem is to place our aircraft industry in a healthy condition, and to do this we must enter without delay upon a sane, sound policy for the development of civil aviation. The relative cost of fostering an organized plan to develop commercial aviation would be much less than the waste that would inevitably result from unprepared entry into war. Aside from military considerations, the fostering of commercial aviation would in time yield adequate returns in itself in the form of promoting and strengthening our means of transportation, advancing the progress of civilization, and increasing the national wealth.

"Reducing to definite form the steps which in the opinion of the National Advisory Committee for Aeronautics are wise and timely, the committee, after careful consideration of all the facts within its knowledge, submits the following specific recommendations:

"First. That legislation be enacted providing for Federal regulation of commercial air navigation, licensing of pilots, aircraft, landing fields, etc. At the present time there is no authority of law for any executive agency of the Government to perform such duties. The committee believes that for the executive administration of these new duties of government there should be established in the Department of Commerce a bureau of aeronautics in charge of a commissioner of air navigation, who should also become a member of the National Advisory Committee for Aeronautics. Acting in cooperation with the War, Navy, and Post Office Departments, the committee has prepared a draft of legislation which appears in full in a preceding section of this report under the heading 'Organization of Governmental Activities in Aeronautics,' and which it strongly recommends for the immediate consideration of Congress. In this connection the committee recommends also the adoption of a policy of Federal aid to the States in the establishment of landing fields for general use in every State in the Union.

"Second. That the Congress authorize an American aeroplane competition in order to stimulate private endeavor in the development of new and improved designs of aircraft, the competition to be under the direction of the National Advisory Committee for Aeronautics, the entries of the successful competitors to be purchased by the Government at a predetermined and announced figure and made available for the use of the Postal Air Service.

"Third. That adequate appropriations be made for the military and naval air services in order to permit the continuous development of these exceedingly important arms of the two services, and to enable them to place orders in such a way as to maintain a nucleus of an aircraft industry capable of sufficient expansion to meet military needs in time of emergency. The committee considers this absolutely essential.

"Fourth. That the control of naval activities in aeronautics be centralized under a naval bureau of aeronautics in charge of a director of naval aviation. At the present time responsibility for the development of naval aviation is divided between the Office of Operations and the numerous bureaus of the Navy Department. This basis of organization does not permit full cooperation with the Army Air Service or with other governmental and civil agencies, nor does it, in the opinion of the committee, promote the efficient development of aviation within the Navy.

"Fifth. That the Air Mail Service of the Post Office Department be further extended and developed. This service has given the best demonstration of the practicability of the use of aircraft for civil purposes. It has been seriously handicapped by inability to secure suitable aeroplanes adapted to its work. The question is one of design, which should be handled by the industry. The remedy lies in the development of the industry, which can only be brought about at an early date by the indorsement and prosecution by the Government of a constructive, comprehensive policy.

"Sixth. That the Congress approve the program of scientific research in aeronautics formulated by the committee and provide for the enlarged facilities necessary for its prosecution. Continuous scientific research is necessary for the real advancement of the science of aeronautics. The number and importance of problems requiring solution have increased greatly with the general development of aircraft, and the development of aeroplanes of all-metal construction will require a large increase in the aerodynamic research and engineering experimentation conducted by the committee at the Langley Memorial Aeronautical Laboratory at Langley Field, Va."

THE NEWS OF THE WEEK

Lecointe Sets a New Record

Paris.—Sadi Lecointe, the aviator, on December 12 broke the world's aeroplane speed record for four kilometers (two and one-half miles). Flying at Villa Coublay, Lecointe negotiated the distance in 46 seconds, or at the rate of 194.5 miles per hour.

On December 16, 1919, Lecointe covered a distance of one kilometer at the rate of 190 miles an hour. For some seconds of this flight he reached a speed of 226 miles an hour.

Canada Buys Airships

Canada is buying airships from England for survey and fire patrol work. Also she expects to find them useful in her seal fishing industry. It is hoped here that these commercial developments in the Dominion will lead to commrecial flying and the establishment of an aeroplane service between Canada and neighboring British islands.

Canada's Government has accepted the gift of nine airships from the home Government, the largest having 200,000 cubic feet capacity and carrying a crew of five men.

Asks the K. of C. to Send Eight Aviators

The Knights of Columbus have received a request that they provide eight aviators, four mechanicians, and twelve mechanics' laborers from a concern formed to operate passenger and mail hydro-aeroplanes between Key West and Havana during the winter. The men must have had experience in the aerial section of the navy. It is the first time the K. of C. employment service has been requested to provide airmen, indicating a scarcity of men in that highly skilled calling.

Naval Pilots Will Fly to Panama

Three days after Christmas the aerial force of the Pacific fleet will leave San Diego for a flight to the Panama Canal and return, according to an announcement made by the Navy Department.

The round trip will mean 6,500 miles of flying. The Navy fliers will spend New Year's Day at Danderas Bay, 1,250 miles south of San Diego, on the western Mexican coast, and will reach Balboa on January 12. The number of planes to take part in the flight has not been specified.

R-38 Nearing Completion

Reports coming from the officers and men in charge of the construction of the dirigible R-38 at Bedford, England, announce that the big ship is practically completed and ready for its first trial flight. It is not expected that the voyage to the United States will be made before May, 1921, when the weather conditions will be favorable for such a flight. The large number of men who were selected from North Island to go to England for instruction have enjoyed their period immensely, although they have worked from early morning to late at night, and they are now looking forward to the great trip across the Atlantic and to the Pacific, where it is expected the large hangar will be erected.

The latest figures of the R-38 give the following facts: Length, 694.5 feet; diameter, 85.5 feet; useful lift, 45 tons; fuel capacity, 32 tons (13 tons available for freight, personnel, etc.); consumption per hour, 180 gallons; cruising radius, 5,600; speed, 60 knots; speed, cruising, 50 knots; complement, 6 officers, 18 men; motors, 6 Sunbeam-Cossack, 350 h.p.; gas volume, 2,724,000 cubic feet hydrogen; dead weight, 35 tons.

Aerial Forest Patrol

In connection with the work for aerial patrol of the National Forests in 1921, for the prevention of fires, the Air Service has requested that fire reserve squadrons be authorized for this work. This project, submitted by Operations Division, has been approved by the Advisory Board, but to date no authority has been granted to put it into effect.

The Ninety-first Aero Squadron, with headquarters at March Field, Riverside, California, was engaged in forest fire patrol during the past season, and, it is contemplated, will continue the work for the coming year.

The location of squadrons for fire patrol in the Western Department is under the jurisdiction of the Commanding General of that Department.

Another headquarters will undoubtedly be at Sacramento, Mather Field, and at Medford, Oregon, and Alturas, Modoc County.

Aerodrome Sites in Luzon

A board of officers, of which Captain E. L. Canady and Roy S. Brown are members, has been appointed for the purpose of selecting possible aerodrome sites in Northern Luzon. One base on the Lingayen Gulf, suitable for both land and sea planes, and another in Ilocus Norte will probably be selected.

Weather Bureau's Annual Report

In his Annual Report, C. F. Marvin, Chief of the Weather Bureau, refers to the flying weather forecasts as follows:

A new form of forecasts, known as "Flying Weather," was begun in July, 1919, at the request of the War Department, for the especial benefit of the Air Service of the Army. The country was divided into seven zones, and a separate forecast made for each of them in the a. m. and certain of the eastern zones in the p. m. Later the number of zones was increased to thirteen. These forecasts are telegraphed directly to the Air Service, which distributes them to the air fields. A typical forecast, which will explain their character, is as follows:

Zones Nos. 1 and 2: Poor flying weather today; local thunderstorms probable; moderate to fresh south and southwest surface winds, becoming west and moderately strong above 3,000 feet.

Similar service has been furnished the Post Office Department as an aid to mail-route aviators ever since the aerial mail system was inaugurated. It is likely that arrangements will be made for supplying similar information for the coastal zones of the Navy. Increased demands for aerial observations and forecasts are inevitable in other directions as aerial navigation develops and as an essential factor of success. Meteorological information and forecasts are destined to become of as much importance to navigators of the air as to navigators of the seas.

Work Commenced on Navy Airship

Philadelphia.—The League Island aircraft plant has begun work on the new fleet, airship No. 1, the first rigid airship to be built in the United States. Modeled on German Zeppelin plans, the airship will resemble the R-38, now under construction in England for the United States Navy. Airship No. 1 will be assigned to the Atlantic fleet for training and instruction in scouting.

Four hundred and thirty-two planes of a dozen types have been turned out by the naval aircraft factory, a survival of the Government's supreme effort to cope with allied demand for air supremacy in the late war. Approximately 350 completed planes, a part of the surplus war material, said to value $55,000,000, awaited disposition today in a huge storage building.

Eighty per cent of the work done in the factory is new construction, while 20 per cent is devoted to experimental research

The aerial convoy that greeted President-elect Harding on his arrival at Newport News

Photo U. S. Army Air Service

and development work, according to Commander G. C. Westervelt, manager.

Commander H. C. Richardson, who participated in the transatlantic flight of the N-C boats in the spring of 1919, is chief engineer of the factory.

The working force has been reduced from the war-time activity of over 5,000 to 1,400. Of that number 200 are women. Approximately $5,000,000 was spent by the Navy Department in building the aircraft factory, which covers forty-six acres. Its group of buildings occupies a floor space of 950,000 square feet.

Columbia Establishes Aeronautic Course

Commencing on February 7, 1921, Columbia University will establish a course devoted to the elementary study of air navigation problems and aircraft. Frank E. McKone, B.S., M.S., a graduate of aeronautical engineering of the Massachusetts Institute of Technology, will be in charge of the course.

In this course some of the fundamental principles of several important elements entering into the employment of aircraft both for war and also for special commercial purposes will receive major consideration. Engineering accomplishments and problems awaiting solution will be described. Possibly lantern slides and illustrative matter of various sorts will be used.

The course will appeal to those who desire to understand and to take some part in this new industry. Some of the topics that will receive consideration are:

I. Present Economic Requirements of Aircraft:

(1) Military and Naval Requirements of Aircraft. (2) Postal Department Requirements of Aircraft. (3) Private Employment of Aircraft. (4) Aircraft Industries.

II. Nomenclature:

(1) Airships. (2) Airplanes. (3) Propellers. (4) Meteorology. (5) Aero Engines. (6) Locomotion by Air. (7) Instruments. (8) Parachutes.

III. Aircraft, Heavier than Air:

(1) Principles of Sustentation. (2) Types of Airplanes. (3) Construction of Airplanes. (4) Characteristics of Typical Airplanes.

IV. Aircraft, Lighter than Air:

(1) Principles of Sustentation. (2) Rigid Airships. (3) Non-Rigid Airships. (4) Construction of Airships.

V. Aircraft Engines:

(1) Principles of the Gas Engine. (2) The Water-cooled Gas Engine. (3) The Air-cooled Gas Engine.

VI. Meteorology:

(1) Properties of the Atmosphere. (2) Storms. (3) Weather Forecasting. (4) Instruments.

An Interesting Take-off

Walter Ainslie, accompanied by U. S. Forester Felix E. Read and Chester A. River, well-known ranchman, made a trip in his machine from Glenwood Springs to Sweetwater Lake, which lake is located at an altitude of over 9,000 feet, and made a successful landing amidst fourteen inches of snow in a very circumscribed area. In order to take-off, Ainslie had to lead the machine toward a precipice, which he went over to secure the necessary speed to start on the return journey.

Smuggle Liquor by Aeroplane

Winnipeg.—Aeroplanes are being used by an organized body of bootleggers for liquor smuggling operations across the United States border, local police reported.

"The officials," according to a local paper, "now have full evidence proving the most thorough and costly organization on the part of law breakers, even to the extent that American smugglers have been and are guaranteed by certain liquor dealers and bootleggers against interference by Canadian law, so that when smugglers are captured the liquor people with whom they do business in Manitoba pay the penalties."

Within the last two months, the paper declared, forty-four automobiles have been seized by the mounted police and customs officials while actually engaged in smuggling operations.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, October, 1920

DIVISION	Gasoline	Grease and Oil	Office Force and Watchmen	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Miscellaneous	Pilots	Mechanics and Helpers	Repairs and Accessories	Interest on Investment	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST					
													Gallons of Gasoline	Total Time Run	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
New York-Washington..	$2,504.46	$312.09	$1,038.55	$1,118.90	$560.99	$546.53	$1,270.13	$3,322.88	$3,157.64	$756.25	$396.78	$14,985.20	6,854	hr. min. 236 06	19,242	2.8	$63.47	$0.78
St. Louis-Twin Cities..	1,508.29	358.93	956.47	480.91	146.93	3,209.23	942.25	2,667.86	876.39	924.10	505.78	12,577.14	4,133	182 23	13,713	3.3	68.96	.92
New York-Cleveland....	3,689.77	460.41	1,535.87	1,475.82	418.24	1,715.21	2,391.31	3,869.59	7,048.81	1,718.75	614.82	24,938.60	10,374	329 01	26,048	2.5	75.79	.96
Cleveland-Chicago.....	3,364.43	581.42	1,187.97	863.62	178.53	2,355.54	1,404.06	2,107.07	2,365.25	1,547.08	614.82	16,569.79	9,695	200 47	17,020	1.8	82.52	.97
Chicago-Omaha......	2,216.98	477.67	730.75	570.06	85.56	1,137.83	2,190.76	2,569.49	2,700.33	425.83	614.82	13,720.08	8,058	237 40	20,566	2.6	57.73	.67
Omaha-Salt Lake....	5,603.01	1,250.21	1,271.48	611.99	287.31	1,694.97	1,838.94	3,606.40	3,264.57	514.17	1,541.27	21,484.32	15,058	480 56	42,049	2.8	44.67	.51
Salt Lake-San Francisco	2,073.00	400.12	1,780.25	706.65	136.35	5,605.50	952.40	3,061.18	3,158.33	310.00	1,159.77	19,343.55	5,838	186 03	15,848	2.7	103.97	1.22
Totals and Averages.....	$20,959.94	$3,840.85	$8,501.34	$5,827.95	$1,813.91	$16,264.81	$10,989.85	$21,204.47	$22,571.32	$6,196.18	$5,448.06	$123,618.68	60,010	1,852 56	154,486	2.6	$66.71	$0.08

Planes operated on New York-Washington Division:
Standard, equipped with Hispano-Suiza motor.
Curtiss R4's, equipped with Liberty 12 motors.
Curtiss JN4D's, equipped with Curtiss OX5 motors.
De Havilands, equipped with Liberty 12 motors.

Planes operated on St. Louis-Twin Cities Division:
Standard, equipped with Hispano-Suiza motor.
Curtiss JN4H's, equipped with Hispano-Suiza motors.
Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on New York-Cleveland Division:
Curtiss R4's, equipped with Liberty 12 motors.
Curtiss JN4D, equipped with Curtiss OX5 motor.
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on Cleveland-Chicago Division:
Standard, equipped with Hispano-Suiza motor.
Curtiss JN4D, equipped with Curtiss OX5 motor.
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Martins, equipped with two Liberty 12 motors.

Planes operated on Chicago-Omaha Division:
Curtiss JN4D, equipped with Curtiss OX5 motor.
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on Omaha-Salt Lake City Division:
De Havilands, equipped with Liberty 12 motors.

Planes operated on Salt Lake-San Francisco Division:
De Havilands, equipped with Liberty 12 motors.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington	$0 20	$0.21	$0.37
St. Louis-Twin Cities..............	.22	.20	.50
New York-Cleveland.	.22	.25	.49
Cleveland-Chicago................	.26	31	.40
Chicago-Omaha...........	.12	.24	.31
Omaha-Salt Lake.....	.10	.21	.29
Salt Lake-San Francisco...	.26	.22	.74
Entire Service.......	$0.18	$0 23	$0.39

OTTO PRAEGER, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Wright Aeronautical Corporation Granted Injunction

Federal Judge Mayer on December 7 granted a preliminary injunction asked for by the Wright Aeronautical Corporation, restraining the Aircraft Disposal Company, Ltd., and Handley Page, Ltd., from bringing into this country British planes.

These planes, alleged to be infringements on the Wright patents, were bought by the two corporations from the British Government. The Wright Aeronautical Corporation asked that the importation of the first lot of machines, numbering 2,365, be stopped because of its patent rights.

It was urged that the shipments of the cast-off British surplus war aircraft be stopped so as to save American aeroplane manufacturers from having their business ruined by the sale of alleged inferior planes in this country.

In granting the preliminary injunction Judge Mayer said, in part:

"The Wright patent has been adjudicated to be valid and a pioneer of wide scope by Judge Learned Hand. The validity of the Wright patent is today universally recognized by the aircraft industry of this country, which has paid, and is paying, substantial royalties. Practically every manufacturer of aeroplanes in this country is licensed, and various importers of British, French and Italian aeroplanes are also licensed.

"The defendants do not question these facts nor deny title, validity or infringement, but put forward the argument that the introduction of these machines will educate the American public to the utility of the aeroplane as a commercial proposition, create a large demand and hence ultimately stimulate American industry to supply that demand.

"The American manufacturer may, however, be trusted to make up his mind what is best for him. His bitter opposition shows that he considers that if these machines are brought here at a price which is but a mere fraction of their actual value such importation will destroy or gravely impair American industry in this regard.

"The defendants acquired these planes from the British Government with their eyes wide open and took their chances on their legal rights—and if a perliminary injunction goes against them they will lose the market and thus suffer great loss. Yet this was their hazard. They should have known that the plaintiff would move expeditiously and diligently, as it has. There are, then, no equities in favor of these defendants and they must rely on their legal rights."

F. B. Rentschler, vice-president and general manager of the Wright company, said that the granting of the injunction would give general satisfaction to the entire aeronautical industry in this country.

"In attempting to enforce its patent rights, the Wright Aeronautical Corporation felt that it was doing a duty to the entire industry in the United States," said Mr. Rentschler. "The British Government had on hand at the close of the war thousands of planes and engines which are now obsolete and which they wished to dump into the United States at prices which were not commensurate with the actual cost of production.

"The United States Army Air Service attempted to aid the industry by getting an anti-dumping measure through Congress at its last session to prevent the sale of these planes and material, but it was held up by other legislation. It is hoped that it will be passed at this session of Congress, and it probably will be, but in the meantime we all feel that Judge Mayer's preliminary injunction will act as a barrier to save us from unfair competition.

"There is one thing which we wish to make clear, and that is we do not want to stifle competition; but we do want our market freed from the sale of planes, engines and parts which are obsolete and of wartime design and production.".

Air Passenger and Mail Service Developed by Marines

The Marine Aviation Force stationed at Santo Domingo City, D. R., is developing air passenger and mail service with highly satisfactory results. Passengers are being taken from one post to another and mail is being delivered whenever a suitable occasion arises. A satisfactory mail service is in effect between Santo Domingo City and Santiago. Also between Santo Domingo City and San Pedro de Macoris. The mountainous and jungle covered conditions of many portions of the island of Haiti render mail service by air much quicker than by any other means. Furthermore, the unsettled condition of portions of the interior is a source of delay to transportation upon land. It appears that aeroplane mail will be the solution of the problem of delays in communication which have been experienced for a long time in Haiti.

Aeronautic Laboratory for University of Illinois

Arrangements have been completed with the war department for the establishment of an air unit at the University of Illinois in connection with the military training department. A laboratory for the ground school and planes, engines, aerial cameras and wireless outfits will be provided by the government, with competent instructors. Illinois is one of the five universities to receive such outfits.

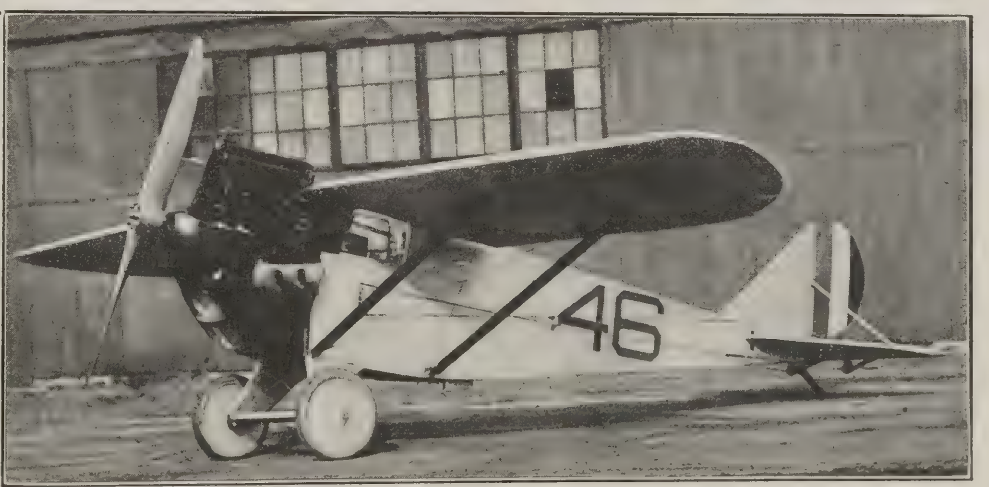
Personal Pars

William Albert Hyde, former Captain, Air Service, has joined the Association from North Haven, Conn., where he is practicing as an electrical engineer and physicist. Captain Hyde was formerly Laboratory Assistant, M. I. T., Electrical Assistant, U. S. Signal Corps, and Electrical Expert of the Navy Department. While at Langley Field he was O. I. C. Research Laboratory.

Rodman Gilder, former Major, Air Service, is now managing editor of *The Credit Monthly*, the official publication of the National Association of Credit Men, 41 Park Row, New York City.

Capt. William F. Volant, Air Service, U. S. A., has been appointed contracting officer for the Air Service at Washington, D. C., relieving Lieut. Francis H. Vanderwerker.

Capt. Ralph P. Cousins is assigned to duty with the Advisory Board, Office of Chief of Air Service, Washington.



The Loening Special 300 H.P. Wright Motored Racing Monoplane, fully described on pages 394 and 395 of this issue

THE GLENN L. MARTIN COMMERCIAL TRANSPORT BIPLANE

AIRCRAFT, if they are to be successful commercially, can no longer be designed solely on the basis of performance as was done during the war. New standards have arisen. The efficient commercial aeroplane of today is judged on its commercial adaptability. Like the locomotive, the automobile and the ocean liner, the commercial features of the aeroplane are paramount.

With this all-important factor of commercial aeroplane construction predominating, The Glenn L. Martin Company of Cleveland is designing a new commercial transport which will incorporate every element of commercial adaptability. Among the principal points that are being carefully considered are the factor of safety, life of the plane, economy in operation, repair and replacement of parts, minimum work in up-keep, simplicity in housing and towing.

Specifications

General Dimensions

Span, overall, both wings	74 ft. 2 in.
Length, overall	43 ft. 7-5/16 in.
Height, overall	15 ft. 6-3/4 in.
Chord	95 in.
Aspect Ratio	9.36
Gap	102 in.
Gap to chord Ratio	1.085
* Dihedral angle	180°
Angle of wing setting to propeller axis	2°
Sweepback, stagger, washout	None
Propeller clearance from ground, horizontal	20 in.

* 176° from folding hinge out in lower wing

Areas (Wings and Control)

Wing curve	Albatros
Upper wing area, including ailerons	577 sq. ft.
Lower wing area, including ailerons	544 sq. ft.
Total wing area, including ailerons	1,121 sq. ft.
Ailerons, 4, each 32.5 sq. ft. Total	130 sq. ft.
Elevator area	43 sq. ft.
Stabilizer area	62.25 sq. ft.
Rudders, 2, each 19.75 ft. Total	39.5 sq. ft.
Fins, 2, each 9 sq. ft. Total	18 sq. ft.

Weights

Total Weight of Machine, fully loaded	12,000 lbs.
Weight of Machine, empty	6,840 lbs.
Total Useful Load	5,160 lbs.
Crew (Pilot and Mechanician)	360 lbs.
Cargo Capacity	3,000 lbs.
Wt. carried per sq. ft. of supporting surface	10.7 lbs.
Wt. per Brake h.p.	15.0 lbs.

Power Plant

2 Liberty 12 cylinder "V" type engines
2 Two-blade, 10 ft. diameter tractor propellers
2 Main gasoline tanks, total capacity 280 gallons, located in the engine nacelles
2 Gravity feed gasoline tanks, total capacity 20 gallons
2 Radiators, honeycomb type, mounted in rear of engines, on top of nacelles
2 Gear-driven gasoline pumps, connected with engines
2 Oil tanks; total capacity 22 gallons, mounted one beneath each engine in the nacelles
2 Bijur rear end starters with batteries and equipment, mounted one in each engine nacelle

A water thermometer, an oil pressure gauge and a gasoline level gauge are mounted on each engine nacelle, in clear view from the pilot's cockpit.

Performance

Speed, Maximum, Horizontal Flight	110 m.p.h.
Speed, Economical	100 m.p.h.
Speed, Minimum Landing	52 m.p.h.
Climb from Sea Level in 10 min., fully loaded	5,000 ft.
Radius of operation, fully loaded under full power	4 hrs. 30 min.
Radius of operation, at cruising speed	600 miles
Ceiling	13,000 ft.

Equipment

This includes: A complete set of instruments:

Air Speed Indicator
Altimeter Compass
Clock
Inclinometer
Lateral Indicator
Tachometers
Self Starters
Navigation Lights
Instrument Lights
Trouble Lamps
Fire Extinguishers
Ammeter
Gasoline Level Gauges
Oil Pressure Gauges
Compass
Oil Temperature Thermometers
All necessary switches, wiring, etc.
Safety Belts
Life Preserver Seat Cushions
Thermos Bottles
Water Temperature Thermometers

Details of Construction

Fuselage

The fuselage is of general rectangular cross section, the maximum depth being 59 inches and the maximum width 50 inches outside. The fuselage is built on four (4) spruce and ash longerons, varying from a solid section to an "X" section, in going from nose to tail. The top longerons are horizontal in flight and parallel to the axis of the motors. The lower longerons taper upward toward the upper longerons as they approach the nose and tail.

The forward section of the longerons is of ash spliced to the spruce. The longerons are solid at fitting bearing points; the nose is braced with 3/32", 3-ply birch plywood walls and built up plywood bulkheads to the rear of the aft cargo compartment. The cargo compartments are lined with plywood, and are braced and reinforced to carry ordinary loads. A cradle and slings are provided in the central compartment for carrying heavy concentrated loads. From this point aft, the fuselage struts are spruce and are routed out to I-beam shape. These spruce struts are stepped in cup fittings, which, in turn, are brazed to the longeron fittings. The longeron fittings are of strap form, made from sheet steel, entirely circling the longeron; each fitting, with exceptions, accommodates six (6) brace wires.

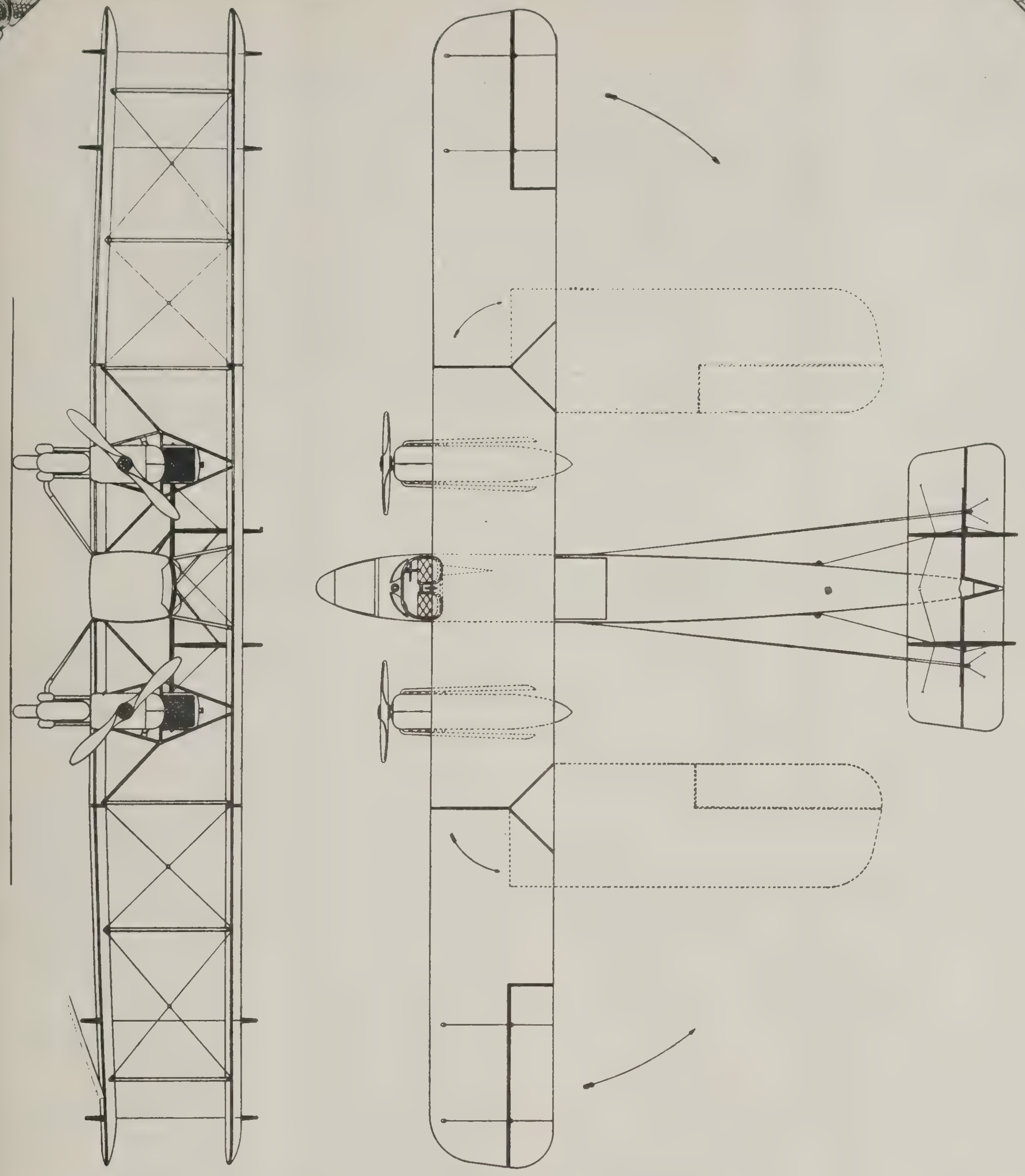
The fuselage flooring is of 3/16" 3-ply birch plywood, suitably braced and secured. Where spruce longeron struts are used, that is, from the pilot's cockpit back, the bracing is of solid steel tie rods. Fitted metal cowling is provided around the pilot's cockpit and metal and plywood doors are provided for the cargo compartments. The tail skid is mounted on a swivel post and secured for shock absorption with 5/8" elastic cord and 3/8" rebound rubbers. The skid is of hickory, provided with a cast steel shoe. All walls of the fuselage, not built with plywood, are covered with grade "A" linen, doped and finished in khaki enamel. The exterior plywood walls are also finished with khaki enamel; the interior wood parts are filled and varnished; interior metal parts are zinc plated, are covered with blue lacquer or both; the exterior metal parts are zinc plated and enameled in khaki; wearing surfaces, etc., are greased.

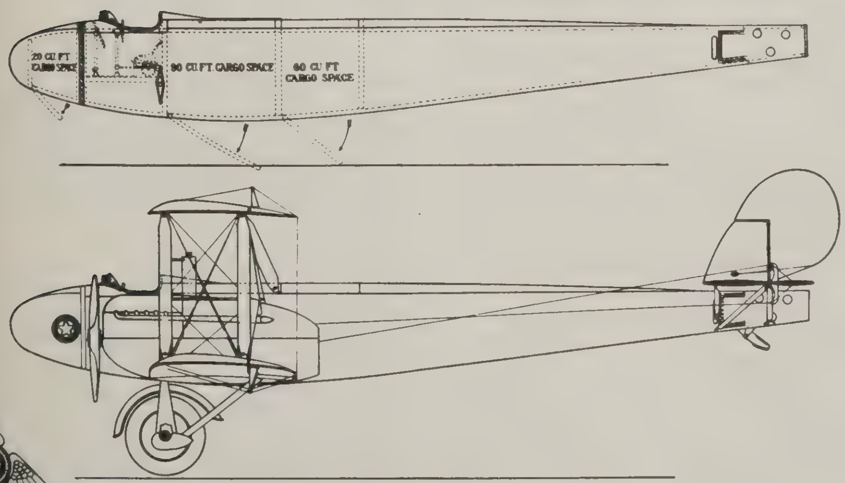
Wings

The wings are constructed in conventional truss form in the outer sections with front and rear spars and interplane struts and streamline wire bracing. The upper wing is made in two (2) outer and one (1) center section and the lower in two (2) left and two (2) right panels; a total of seven (7) panels. The interplane struts, outside of the folding wing hinge, are of routed spruce; two (2) front and two (2) rear on each side of the wings. Tubular steel struts, faired with aluminum are used at the folding wing hinge. The strut system around the motors, on the lower inner panels, consists of a truss work of steel tubes, faired with aluminum, which connects the nacelles to the body, to the landing gear, and to the upper wing. The wing truss wires are of streamline wire, fitted with terminals of clevis form.

Wing panels are built on two (2) spruce spars, routed wherever possible to I-beam sections; the front spar is 10" from the leading edge and the rear spar, 60". In the inner lower wing sections, an auxiliary triangle of steel tubes, inside the wings, carries the stress in the lower rear spar from the engine nacelle to the front beam at the body hinge and to the hinge fitting at the rear of the cargo compartment, in the body. The ribs are of truss type, diagonal and vertical bracing, and are built of spruce; spruce drift struts are used to carry the drag loads and spruce box ribs, to close the ends of the panels.

The four (4) ailerons are attached to the rear spars, upper and lower, at both sides of the machine. The ailerons are unbalanced and do not extend beyond the contour of the wings. The wing fittings are of plate form, made of sheet steel with attached parts brazed and secured to the beams by through bolts with bearing blocks of metal. Fittings take interplane strut bolts; flying, landing, incidence and internal drag, brace wires. The internal wing wires are of solid steel fitted with adjustable terminals. The wings are covered with grade "A" linen and doped with 4 coats of acetate and 2 coats of nitrate





THE GLENN L. MARTIN COMMERCIAL TRANSPORT BIPLANE

dope, in the order named, the latter being impregnated with khaki wing enamel. The wood frames of the wings are wood filled and varnished.

Landing Chassis

The landing chassis is attached under the fuselage and engine nacelle and consists of two (2) 44″ x 10″ wheels and two (2) nickel steel tubular axles. The axles are held in place laterally by the medium of sway braces attached under the fuselage and support the machine by means of "A" struts. These struts are vertical; two (2) being attached under each nacelle. The landing gear "A" struts are of nickel steel tubing and are braced from the rear. Each wheel is shock absorbed with 5/8″ elastic cord and the shock absorber is enclosed in a streamline; mud guards are provided for each wheel. The landing gear "A" struts are streamlined with wood and covered, where necessary, with grade "A" linen, doped and finished in khaki enamel. The sway braces are streamlined with aluminum and magnesium fairing and are provided with steps to facilitate work upon the motor when the engines are not running.

Tail Surfaces

The tail surfaces consist of elevator, stabilizer, 2 rudders and 2 vertical fins, all built upon the stabilizer. The elevator is hinged to the trailing edge of the stabilizer and the rudders and fins are mounted on top of it. Entire unit is mounted on top of the fuselage tail and braced with steel tubing and steel tie rods or cables.

The tail surface unit may be detached intact. The stabilizer is adjustable from 0° to minus 4° from the pilot's cockpit, during flight. All tail surface frames are of steel tubing and are channel section. The frames are enameled and covered with grade "A" linen. The covering is doped and finished with khaki wing enamel.

Power Plant

Each engine is mounted in the forward portion of its nacelle. The engine bed is built in the top of a vertical plywood bulkhead, braced laterally by a horizontal plywood bulkhead, connecting it to the nacelle longerons. A sloping bulkhead connects the forward end of the engine bearers to the front spar of the wing. The oil tanks are carried beneath the motors. The batteries are carried beside the starters at the rear end of the motors. Directly behind the rear end of the starters is an aluminum covered plywood fire wall, which runs from the top to the bottom of the nacelle. On top of the fire wall and outside of the nacelle is the radiator. Behind this fire wall and separated from it by an air space, is the gasoline tank. The gasoline tank ends at the rear spar where there is another vertical bulkhead. Behind this bulkhead is a fairing to streamline the nacelle. A removable cover is provided for this, making it available for the storage of tools, etc. Detachable cowling is also provided over the motors. All cowling on the nacelles is sheet aluminum.

The engine controls are carried to the fuselage through the wings, being run over pulleys at the nacelles and at the inner end of the wings and being run through straight aluminum tubes between these points. All controls are standard cable. A gravity tank is provided in the upper wing over each motor, and a sight glass in the overflow line enables the pilot to determine at all times, whether gasoline is being pumped to the gravity tank.

The entire gasoline system is designed to withstand a pressure of 5 pounds per square inch.

THE LOENING SPECIAL MONOPLANE

ONE of the fastest aeroplanes entered in the Pulitzer Trophy Race at Mitchell Field on Thanksgiving Day was the Loening Special Monoplane, piloted by Lieut. B. G. Bradley, U.S.M.C. Although this machine competed against biplanes of greater horsepower, it put up a remarkable performance both for speed and control. Both in preliminary test flights and during the Race, the monoplane proved to be extremely manoeuvarable, especially on the lateral controls. When consideration is given to the fact that the wing has a span of only 30 feet and each aileron only 4.2 square feet, it will be seen how unusual the performances are.

During the Race the propeller was turning up only about 1,850 to 1,900 revolutions in the air, and the speed obtained was estimated to be more than 160 miles per hour. The engine power is rated at 2,000 r.p.m., and developing its full power would have added still more miles to its speed.

Following is a table of general dimensions, weights and areas:

General Dimensions

Wing span	30′ 5⅜″
Wing chord	6′ 0″
Overall length	24′ 2½″
Overall height (at wings)	6′ 7″

Weights

Weight, light, with water	1,450 lbs.
Load (gas and oil)	250 lbs.
Pilot	150 lbs.
Total weight (in racing trim)	1,850 lbs.
Loading per square foot	12.5 lbs.
Loading per horsepower	5.5 lbs.

Areas

Wings (with ailerons)	148.0 sq. ft.
Elevator	14.0 sq. ft.
Stabilizer	16.0 sq. ft.
Rudder	6.5 sq. ft.
Vertical fin	7.0 sq. ft.

Main Planes

Wings are attached to upper longerons in two sections secured to either side of the body with pin joints at the wing spars. Wing spars are carried through the body fore and aft of the pilot's cockpit, the space between them being left open for vision.

The drawing shows how the trailing edge is rounded off at the wing tip, a rather bold experiment in monoplane design inasmuch as the ailerons have considerably less leverage than the conventional form of wing tip makes possible. The aileron area is extremely small and indicates that the machine's manoeuverable qualities are brought about by good balance and inherent stability in design. Ailerons are controlled by cables run in a very direct maner. The cable from the control stick leaves the body through the ends of rock shaft tube and run to a pulley on the underside of the upper wing at the front wing spar, and thence back to the underside of the aileron. Compensating cables connecting the upper levers and ailerons are run through the wing just aft of the forward wing spar. The strut braces running from the bottom of the fuselage are not figured as possessing lift as in the other Loening Monoplanes. They are attached to the wings at points 6′ 8-3/16″ from the body; this leaves an overhang of 7′ 6″. There is a gap between the wings and the fuselage of 1-1/16″.

Fuselage

The fuselage is characterized by its extreme depth, permitting the use of a landing chassis of diminutive proportions.

The engine is cowled with an easily removable cowl but a considerable portion of the engine cylinders are left protruding. The radiator is located below the engine in an advantageous position for cooling. Air reaches the radiator through an oval aperture in the cowling. Shutters operated from the pilot's seat regulate the amount of air reaching the radiator. The fuselage has a constant width of 25″ throughout its entire length. The top longerons taper in a straight line very slightly from the rear wing beams to the fin. The rear portion of the underside has a considerable curve which terminates the fuselage in a horizontal knife edge. An opening is cut on either side of the body between the wings for the pilot's vision. This, in addition to the opening between the wings, gives the pilot a good deal of vision in every direction.

Tail Surfaces

The stabilizer is in two sections 3′ 8½″ in chord on either side of the body. The surfaces are adjustable. The rear beam is braced to the fin. The elevator is in one continuous surface, 20″ x 8′ 10″.

The fin and rudder are of the usual Loening design. The rudder is of the balance type.

Landing Gear

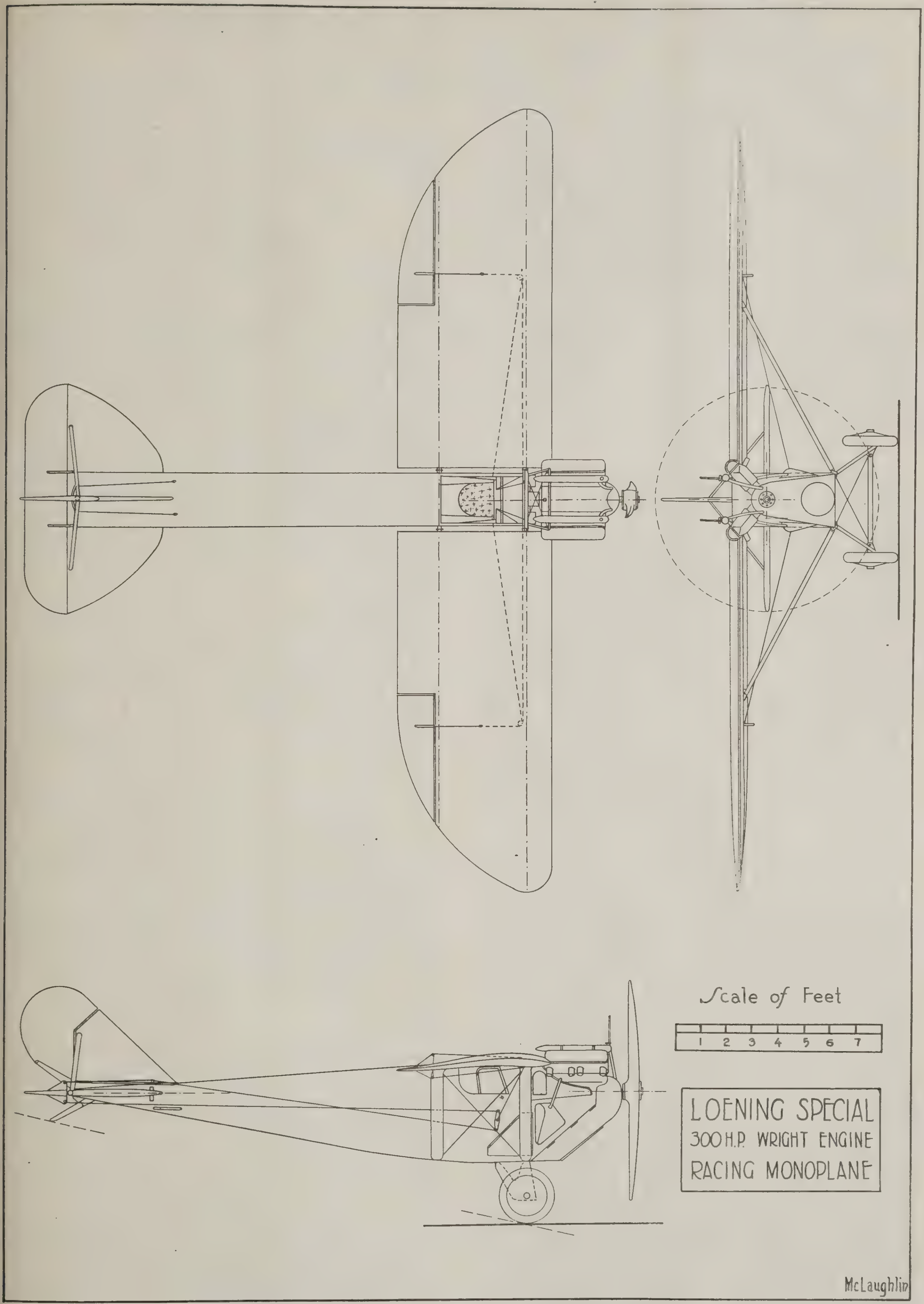
Wheels are 26″ x 4″ with a 4′ 7″ tread. The axle is located 15⅝″ from the under side of the body and 4′ 0-23/32″ from the center line of the propeller shaft. The tail skid is located at the stern post. When in flying position a line drawn from the tail skid to the landing wheels makes an angle of 12½° with the ground line. The propeller hub is 5′ 2″ above the ground line with an 8′ 8″ diameter propeller. Clearance to the ground is about 9½″.

Engine

The engine is a stock Wright engine (Hispano-Suiza Model H) rated at 300 H.P., but developing 340 H.P. at 2,000 r.p.m.

The system of water cooling is of a peculiar type developed by Mr. Loening. The expansion tanks for the engine water are located in streamline containers above the cylinder blocks.

It will be noted on the drawing that the stabilizer is located at the center of propeller thrust and that the main wings also are but slightly above the center of thrust. The advantageous positions of these surfaces may account in a large measure for the well balanced control which this machine exhibits throughout its full range of speeds.


Scale of Feet
1 2 3 4 5 6 7
LOENING SPECIAL
300 H.P. WRIGHT ENGINE
RACING MONOPLANE
McLaughlin

ANNUAL REPORT OF THE DIRECTOR OF THE AIR SERVICE

(Continued from last issue)

Events Connected with the Proposed Department of Aeronautics

During the past year proposed legislation for the establishment of a Department of Aeronautics, to embrace the aerial activities of all Government departments, has been considered by Congress. It is not desired in this report to enter into a discussion of this question. However, in the publicity given to the consideration by Congress of this subject the public has been more or less incorrectly informed in two particulars of such importance that it is deemed advisable to present the correct information herein. The first of these particulars concerns the position taken by those charged with the direction and control of the activities of the Air Service with reference to the questions of Federal control of air navigation and the establishment of an aircraft industry. The attitude of the Director of Air Service is correctly set forth in the following conclusions arrived at and adopted by the Board of Officers, convened to report upon the creation of an executive Department of Aeronautics, of which board the Director of Air Service was the president.

Conclusions

(1) Peace-time air fleets at all adequate in size for war needs can not be maintained by any nation. The great air fleets necessary for war must be produced after war begins.

(2) To provide facilities for aircraft production at the beginning of war commercial aeronautics must be developed.

(3) Under present conditions, the only effective stimulant to the development of commercial aeronautics is Government assistance in large annual appropriations guaranteed for a period of a considerable number of years. If this policy be adopted by the Government, these appropriations, in order to accomplish the result desired, must be continued until commercial aeronautics can stand by itself as a dividend-paying business.

(4) The Government itself should not undertake the production of aircraft in Government factories unless trade combinations in the production of military aircraft should eventually be formed against it.

(5) Federal agencies should be provided for the adequate control of various national and international matters connected with aeronautics.

(6) A single Government agency should be responsible for the procurement of all aircraft used in the Government service.

(7) A single Government agency should have charge of all development work, in so far as same is common to all branches —military, naval, and commercial. This agency should be provided with the means to carry on experimentation and research.

The Secretary of War, being keenly alive to the necessity of coordinated action along the lines indicated above and to the interests of all Governments departments and of commercial aviation, initiated action which resulted in an investigation of the subject of air navigation by the representatives of the following departments: War Department, Navy Department, Treasury Department, Department of State, Department of Agriculture, Department of Commerce, Department of Labor, and also a representative from the National Advisory Committee on Aeronautics, acting as a single committee. Senate bill 4470 and House resolution 14061, as introduced at the last session, will serve to bring to the attention of the proper committees of Congress the fundamental considerations which this interdepartmental committee found as being those which must be dealt with in securing a proper solution of the subject.

These facts are cited to prove beyond all doubt that those who direct the Army Air Service have neither attempted to throttle aeronautics nor sought to retain within their authority the control of any aerial activity that was not vitally necessary to the preparedness of the Army for an emergency and to its operations in war.

The other matter on which the public has been incorrectly informed concerns the recommendations of General Pershing concerning the establishment of a department of aeronautics. At his appearance before the Senate and House Committees on Military Affairs, General Pershing expressed his views at considerable length in regard to the needs of the Air Service. At that time legislative authority for the establishment of the Air Service as a branch of the Army separate from the Signal Corps and coordinate with other arms had not been attained. General Pershing recommended that the Air Service be established as a separate corps of the Army—not as a separate executive department. To correct an apparent misunderstanding as to his views, a letter was addressed to General Pershing by the Director of Air Service on December 16, 1919. His reply to this letter, under date of January 12, 1920, was as follows:

General Headquarters, American Expeditionary Forces,
Old Land Office Building, Washington,
En route Denver, Colo., January 12, 1920.

Maj. Gen. Charles T. Menoher,
Director of Air Service, War Department, Washington, D. C.

My Dear Gen. Menoher: I am at a loss to understand how my opinion on the question of a separate Air Service as expressed at the joint meeting of the Senate and House Committees on Military Affairs could be misinterpreted. In those hearings, and on many other occasions, I expressed my view that the Air Service for military purposes should remain a part of the Army. I urged, of course, the very great necessity for developing aviation in a commercial way and for other than military purposes as an invaluable adjunct to military preparation in time of peace.

Before the joint meeting of the Military Affairs Committees I indicated my belief that some cooperation and coordination between the different departments of the Government using airships might well be obtained, and, in fact, that such coordination was essential to the development of aviation. The question of coordinating the industrial end of aviation is, of course, an entirely different matter from the proposition of taking away from the Army this Air Service and establishing a department of aeronautics independent of the control of the War Department.

I am very glad to answer the questions you asked in your letter specifically, and I am giving my answers below the same headings that you gave your questions.

2. (*a*) Military forces can never be efficiently trained nor operated without an air force.

(*b*) An air force acting independently can of its own account neither win a war at the present time nor, so far as we can tell, at any time in the future.

(*c*) An air force by itself can not obtain a decision against forces on the ground.

(*d*) A military air force is an essential combat branch and should form an integral part of the Army.

(*e*) If success is to be expected, the military air force must be controlled in the same way, understand the same discipline, and act in accordance with the Army command under precisely the same conditions as other combat arms.

(*f*) An air force, as well as all other branches of the military organization, must fully understand its exact functions in working with other branches, must know the needs of other branches, be in full sympathy with them, think in the same military atmosphere, and have the same esprit de corps in order that effective battle control may be established.

(*g*) No such force can realize the above conditions unless it be an integral part of the command not only during battle, but also during the entire period of doctrinal training.

(*h*) To realize these conditions the different arms of the service must live together and train together.

(*i*) An air force should be established as a separate arm of the service, and coordinate with the Infantry, Cavalry, and Artillery.

(*j*) An air force should not be established as a combatant force distinct from the Army and Navy.

(*k*) The only view that I have ever expressed on the question of the Air Service for military purposes is that such service should be established as a separate branch within the Army, and separate only in the same way that Infantry and Field Artillery are separate.

On my present tour of inspection I have had occasion several times to refer to my opinions on the Air Service. I shall probably again refer to this question, but I have no objection to your utilizing this letter in any way you see fit.

Very truly yours,
(Signed) John J. Pershing,
General of the Armies of the United States.

III. Appropriations and Legislative and Executive Authorizations

This chapter includes a summary of important decisions reached and of plans approved by higher authority and made possible of accomplishment by legislative enactments as well as an account of Air Service appropriations and expenditures.

Appropriations and Expenditures

The Army appropriation bill of July 11, 1919, granted only $25,000,000 to the Air Service for this fiscal year. These funds have been allotted as follows:

Status of appropriation "Air Service, Army, 1920," as of June 30, 1920

	Appropriation	$25,000,000.00
	Credits to date	612,613.20
	Credits due from Navy Department.	227,584.20
	OBLIGATIONS	
701.	Maintenance and operations of aviation schools	$277,838.94
702.	Photographic supplies for aerial observers	135,554.47
703.	Improvements of aviation stations, balloon schools, and testing plants	5,705.75
704.	Maintenance and operation of stations	2,042,258.74
705.	Development of helium	483,900.00
706.	Utilities at stations	488,347.64
707.	Lease of lands and rental of buildings	408,229.01
708.	Salaries and expenses of civilian employees[1]	8,184,285.29
709.	Experimental and research	2,438,544.50
710.	Production and purchase of airplanes and their spare parts (this item has been used this year for maintenance).	4,290,536.38
711.	Production and purchase of balloons and airships and their spare parts (this item has been used this year for maintenance)	751,290.62
712.	Production and purchase of engines and their spare parts (this item has been used this year for maintenance)	1,496,244.16
713.	Production of instruments and accessories for aircraft and engines	791,890.28
714.	Construction of gas plants, hangars, and repair shops	834,060.37
715.	Purchase, manufacture, and issue of special aviation clothing and similar equipment	981.38
716.	Necessary expenses connected with disposal of surplus material[2]	2,343,054.18
717.	Services of consulting engineers	3,089.89
718.	Establishment of aviation stations in the Philippine Islands	350,000.00
719.	Claims for damages not exceeding $250	972.70
720.	Expenses of officers while traveling by air	2,000.00
721.	Miscellaneous expenses.	414,621.76
		$25,743,406.06
	Balance	96,791.34
		$25,840,197.40

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[1] See 716. [2] Includes hire of civilian employees.

The inadequacy of these appropriations is evidenced by the diversion of allotments from the needs of new equipment to the necessities of maintenance and operation.

In addition to the above appropriation, there were available certain balances from fortifications appropriations acts of previous years. The status of these appropriations on June 30, 1920, was as follows:

	Appropriation or apportionment, July 1, 1919	Obligations, June 30, 1920	Unobligated balance	Reserved	Free balance
Aviation, seacoast defenses	$2,898,093.64	$2,826,488.91	$71,604.73	$20.00	$71,584.73
Aviation, seacoast defenses, insular possessions:					
Hawaiian Is.	364,771.63	379,715.40	[1]14,943.77	13.61	[1]14,957.38
Philippine Is.	581,546.86	447,029.61	134,517.25	117,758.50	16,758.75
Panama	19,235.33	19,235.33	....	....	....
Aviation stations, seacoast defenses	7,579,958.52	4,061,750.00	3,518,208.52	451,013.50	3,067.195.02
Inland and port Service and Supplies factory	1,267,300.00	1,261,744.23	5,555.77	5,699.77	[1]144.00

[1] Deficit.

Note.—No further obligations of the above appropriations can be incurred and the free balances of June 30, 1920, will ultimately be covered into the Treasury.

Despite the great need of facilities in conjunction with our seacoast defenses, for which these sums were appropriated, the construction of the major portion was impossible because the Army appropriation act of July 9, 1919, contained a clause so worded as to prohibit the acquisition of the necessary lands.

LEASES

At the beginning of the fiscal year 1920 there were fifty-one land units (as distinguished from storage and office units) occupied under lease at a total annual rental of $171,844.80. During the year there have been relinquishments of leased fields as follows: Call Field, Payne Field, Eberts Field, Carruthers Field, Hazelhurst and Roosevelt Fields, Buffalo Acceptance Park. These relinquishments amounted in the aggregate to 3,985 acres, which were held under lease at an annual rental of $43,823.62.

Of the eighteen storage units under lease at the beginning of this fiscal year, the greater number were used for housing material designated for sale or salvage. The annual rental for storage space amounted to the sum of $426,456.52. During the year this storage space has been reduced, so that on July 1, 1920, there were six storage units held under lease at an annual rental of $90,350.43, and plans are in operation to dispose of the stored material and relinquish all this space within a short time.

The annual rental of the six office units which were under lease at the beginning of the fiscal year 1920 amounted to $58,720.65. This space has all been disposed of during the year except a small office at Charleston, S. C., and an office in the Pelouze Building at Chicago, Ill., both of which units have been absorbed into headquarters of the commanders of the respective departments in which they are located.

The total annual rental of projects under lease at the beginning of the fiscal year 1920, if there had been no changes nor relinquishments, would be summarized as follows:

Fields	$174,844.80
Storage	426,456.52
Office	58,720.65
Total	$657,021.97

These rent charges have been reduced by relinquishments and by purchase of land and reduction in storage, so that at the end of the fiscal year 1920 a summary statement is as follows:

Fields	$138,697.82
Storage	90,350.43
Office	0
Total	$229,048.25

The air patrol maintained along the Mexican border made necessary the acquisition by lease of border-patrol stations at McAllen, Laredo, Del Rio, Sanderson, and El Paso, Tex.; Douglas and Nogales, Ariz.; and El Centro, Calif. The use of these fields is covered by thirty-three leases, most of which are for a nominal amount, the total rental being $744.50.

In addition, there have been new facilities acquired by lease during this fiscal year, as follows:

	Rental
Flying field for Northeastern Department at South Framingham, Mass.	$2,250.00
Strip of land along west side of Scott Field, three leases	46.56
Packard Test Field at Detroit, Mich.	1,500.00
Right of way for railroad at Chanute Field	84.70
Haskelite Manufacturing Corporation (two storage plants in Michigan)	39,997.08
Ohio Seamless Tube Co., Shelby, Ohio	879.60
Total	$44,757.94

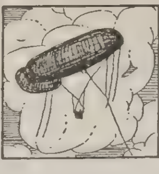
FUNCTIONS OF ARMY AIR SERVICE AND OF NAVY AIR SERVICE

A notable development of the year has been the determining of a policy for the joint and separate operations of the Air Services of the Army, Navy, and Marine Corps. That policy, as approved by the Secretary of War and by the Secretary of the Navy, allots functions as follows:

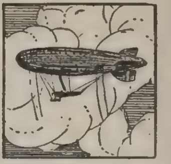
Army aircraft.—(Those provided by the War Department and manned by Army personnel.) Operations from bases on shore as an arm of the mobile army; against enemy aircraft in defense of all shore establishments; alone or in cooperation with other arms of the Army or with the Navy, against enemy vessels engaged in attacks on the coast, such as bombardment of the coast, operations preparatory to or of landing troops, operations such as mine laying or attacks in the vicinity of defended ports.

Navy aircraft.—(Those provided by the Navy Department and manned by Navy personnel.) Operations from mobile floating bases or from naval air stations on shore; as an arm of the fleet; for oversea scouting; against enemy establishments on shore when such operations are conducted in cooperation with other types of naval forces or alone when their mission is primarily naval; to protect coastal sea communications by reconnaissance and patrol of coastal sea areas, convoy operations, attack on enemy submarines, aircraft or surface vessels engaged in trade prevention or in passage through the sea area; alone or in cooperation with other arms of the Navy or with the Army against enemy vessels engaged in attacks on the coast.

(*To be continued*)



FOREIGN TÉCHNICAL DIGEST



Beardmore Flying Boat, WB-9

This machine is suitable for long distance passenger or mail carrying, and is designed for long range and low landing speed.

The folding under-carriage enables the machine to alight upon land, or be hauled up a slipway, while for rapid housing the wings are easily folded, reducing its span from 107 feet to about 51 feet. Fully loaded the machine weighs 14,000 pounds (9,520 pounds light), giving a wing loading of 6.35 pounds/square feet, or 19.4 pounds/horsepower. The load carried is distributed as follows:

	Pounds
Passengers	1,600
Luggage (20 pounds/passenger)	200
Pilot and engineer	360
Petrol	1,900
Oil and water	420

When fully loaded the boat attains a ground speed of 93 m.p.h., falling to 82 m.p.h. at 10,000 feet, and a landing speed as low as 46 m.p.h. At ground level its rate of climb is 480 feet/minute, with a ceiling of 11,000 feet. The machine is designed for a range of 403 miles.

The power plant consists of four 185 h.p. Beardmore 6-cylinder vertical type silenced, placed in the hull, two engines to port and two to starboard. The two propellers are laminated mahogany brass tipped, four bladed, with a diameter of 12 feet 6 inches. The ability to stop and disconnect one of the engines while the other three are running is an advantage which puts the flying boat more on a level with an airship as regards reliability.—*Aeronautics,* August 18, 1920.

The Morane-Saulnier Parasol Type A R

This is a description of one of the postwar types made by Morane-Saulnier.

The type is a low two-seater parasol monoplane intended for sporting or touring purposes. It has an 80 h.p. Le Rhone engine mounted in the front of a rectangular sectioned fuselage. The undercarriage is of the V-type, with the addition of a central Vee pair of struts; the struts are of streamline sectioned steel tubing welded at their junctions with each other. The wings are made in two parts, the central portion being cut away so as to give the crew a good view; the wing section has been selected so as to give a good performance at all altitudes. It is of constant section throughout the span, and has no dihedral. A central cabane in streamline steel tubing supports the top load-wires, of which four are fitted to each side of the machine. The ailerons are controlled by means of long tubes running in extension of the aileron hinges to the center of the wing, whence the tubes are connected by means of rods to the control lever; this method avoids the use of cables and is more rigid.

The overall length, span, and height are 10.565 m., 6.767 m., and 3.405 M. respectively. The total lifting surface is 21.900 sq. m. The fuel weight is 67 kg., and the useful weight 160 kg. (for the crew); the total flying weight is about 627 kg., giving about 28 kg. 630 per sq. metre of wing area.

This machine can be fitted with either a flat or a cambered type of wing; the former gives a higher maximum speed (153 k. per hr.) and the latter a lower maximum speed (132 k. per hr.), but the climb and ceiling are greater with the latter type, and the landing speed lower. The climb is 2,000 m. in 9 m. 45 sec., and 4,000 m. in 25 min. 40 sec. with the cambered wing, with a ceiling of 6,000 meters. Fitted with the flat wing, the machine has a climb of 2,000 meters in 11 min. 15 sec., and 5,000 in 50 mins. The flying endurance of this machine is 3 hours. (*L'Aviation Commerciale,* Mar., 1920. 2 pp., 1 diag.)

Bending Stresses in a Rigid Airship

The stresses in the longitudinal girders due to the bending of the ship as a beam are considered. The first part of the article deals with experiments carried out on a built-up hexagonal tube fixed at one end as a cantilever, divided into six bays. The girders were of wood and the panels braced diagonally with steel wire. A load was applied at different points, the tensions in the wires measured and the stresses transmitted to the longitudinals computed.

The author proceeds to deal with the general case and obtains formulæ for the shear force on any particular bay. The method is applied to an airship (R. 31 Class) neglecting taper and taking the section of maximum bending moment as the fixed end of the cantilever. The distribution of bending stresses is governed by (1) the shape of cross-section of the ship, (2) loading of ship, (3) variation in diameter of diagonal wires, (4) relative stiffness of diagonal wires, and longitudinal girders, (5) slope of diagonal wires to longitudinals. (E. H. Lewitt, *Aeronautics,* Sept. 9, 1920.)

Four Motor Bréguet—Bugatti System

This description refers to the 1,000 h.p. installation obtained by coupling four standard aeroplane engines together.

In a general survey of the various large power units in use attention is directed to the ordinary dispositions of the engines outside the fuselage, which possess the disadvantages of giving augmented head-resistance, and complicated engine-support structures. An example is given of two machines of 700 h.p. and 750 h.p. respectively; the former being enclosed in the fuselage gives a total speed of 260 k. per hr., and range of 5,000 km., whilst the latter gives only 160 k. per hr. and a range of about 2,500 km. The present system consists of four groups of engines, each engine being of the eight-cylinder vertical type and acting independently except as regards the crankshafts, which are coupled two and two on the common driving shaft of the propeller. Two parallel engines are arranged in line with but a little above the other two parallel engines, and drive through helicoidal pinions a common crown-wheel to the shaft of which the propeller is attached; a reduction gear of 2 to 1 is arranged in this gearing. An ingenious device depending upon the axial thrust, under the driving torque of each engine, automatically disconnects any engine which falls off below a given power output and cuts off the gas supply. The axial pressure on each of the pinions is normally balanced by the pressure of a spring, so that when the torque of an engine falls below a certain value the spring pushes the pinion axially and disengages its drive from the common crown wheel.

The system also embodies a means for synchronizing the speeds of the four engines. The central crown wheel is flexibly coupled to the airscrew driving shaft.

The cylinders of each engine, which are in groups of four bolted to the crank-case, are of 110 mm. bore, the piston stroke being 160 mm. The inlet valves are of 34.5 mm., and exhaust valves 50.5 mm. diam.; the total valve area is 41 per cent. of the piston area. The exhaust orifices are separate, each cylinder exhausting into a common manifold lying between the two rows of engines. The inlet orifices are in pairs, however, and one carburetter per pair of cylinders is provided, so that there are four per engine. Aluminium pistons are used. The valves, which are of the overhead type, are situated vertically in front of the cylinders, the inlets having two, and the exhausts three springs. The inlet valve opens at 0° and closes at 45° past dead center, whilst the exhaust opens at 45° before dead center and closes at 25° after dead center.

Dual ignition is provided with two magnetos turning at engine speed for each group of eighty cylinders. Numbering the cylinders from 1 to 8 for one engine and from 9 to 16 for the second engine of one group, facing the engine with the second engine on the right hand side, the order of firing is 1, 15, 5, 12, 3, 16, 7, 10, 4, 14, 8, 9, 2, 13, 6, 11. (E. H. Lemonon, *L'Aviation Commerciale,* Apr. and May, 1920. 2½ pp., 1 diag.)

The New Schutte-Lanz Airship

Particulars are given of the construction and dimensions of the latest type of Schutte-Lanz airship.

This airship has a capacity of 2,048,360 cubic feet, an overall length of 650 feet 8 inches, and a maximum diameter of 75 feet 6 inches. It is fitted with five 240 h.p. Maybach motors, which give it a speed of 62 m.p.h. Its carrying capacity is 37.5 tons. Particulars are given of the hull construction, which consists of 19 principal rings, 32 feet 10 inches apart, connected by hand-drawn duralumin tubular lattice girders, running longitudinally. The engine gondolas are anchored to the main rings both horizontally and vertically; in the latest design two motors driving one propeller are enclosed in one gondola. The following is the weight analysis:

	Tons
18 Gas-bags	3.380
Covering for framework	1.870
Keel surfaces and rudder	1.070
Engine and pilot gondolas	1.860
Safety appliances and steering gear	.340
Motors and machinery	4.540
Petrol tanks and piping	.480
Tanks for water ballast	.350
Suspension ropes, stays, signalling devices, lighting equipment, wireless, etc.	1.030
Hull and lattice bracing	12.900

The gas-bags are made of a special cotton material to which goldbeater's skin is secured by waterproof glue; it is estimated that about six tons weight is saved over the usual rubber impregnated cotton covering. The framework is still made of wood, for airships up to 1,300,000 cubic feet capacity, but the use of duralumin is stated to save from 20 to 30 per cent of the weight of wood. The water-ballast tanks are suspended in the interior tunnel corridor and consist of bamboo frames covered with waterproof cloths, each containing 0.50 to 1.00 tons of water.—(D. Ruehl, *De Ingenieur; Aviation,* Oct. 1, 1920. 1 paragraph.)

NAVAL and MILITARY AERONAUTICS

Admiral Welles Makes Flight in F5L to San Pedro

The two-starred flag of Rear Admiral Roger Welles, Commandant of the San Diego Naval Base, was shifted from the North Island Naval Air Station signal bridge to the outboard strut of an F-5-L-type coastal seaplane, last week, when he made an official trip to San Pedro, headquarters of the Pacific Fleet. Following a conference at the northern port with Admiral Hugh Rodman, the Commandant returned to the local base.

Bombardment Group Activities at Kelly Field

Thursday of last week was observed as Group Organization Day by the First Day Bombardment Group. Addresses were given by Lieutenants Palmer, Commanding Officer, by Chaplains Monahan and Swanson, also by Lieutenant W. R. Maynard. Lieutenant Maynard is the only officer present who served overseas with the Bombardment Group. The history of the Group was read to the men. On November 6, 1918, a 35-ship formation crossed the enemy lines on a bombing raid. As a defensive unit they shot down nineteen German ships, and only lost two of their own. On this mission several thousand pounds of bombs were dropped, causing considerable damage to enemy fortifications. The afternoon was declared a holiday!

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172 Flights at March Field

One hundred and seventy-two flights were made from March Field during the past week. Flying time was 143 hrs. 45 min.; including 54 hrs. 35 min. preliminary instruction; 38 hrs. 35 min. advance instruction; 46 hrs. 55 min. miscellaneous flights, and 3 hrs. 20 min. test. Approximate mileage covered 9,130.

122 Graduate from Air Service Mechanics School

During the month of October 102 students were graduated from the Air Service Mechanics School; 58 were graduated from the Course for Engine Mechanics; 15 from the Course for Aeroplane Mechanics and Parachute Repairmen; 5 from the Course for Parachute Repairmen; 14 from the Course for Aeroplane Mechanics; and 10 from the Course for Auto Repairmen. At the completion of their work, these men were sent to nineteen different Air Service Stations in the United States.

Post Field to Fabricate Complete Spherical Balloon

The basis of successful endeavor is a thorough knowledge of essential details. The Balloon and Airship personnel are realizing this, and an example of this realization is given at Post Field, Fort Sill, Okla. It is planned to fabricate at this field a complete spherical balloon. The work is to be done by the enlisted men of the field under the direction of the officers. The balloon will be made of salvaged materials. The men will select the fabrics, test them, cut them, fit them, and assemble them in the finished balloon. Further than this, it is planned to make a net for the ballon with all the difficulties of rigging-assembly which that entails. This ballon is expected to fly in regular free balloon service. The man who flies in that balloon, knowing that it is a product of his work and that of his associates, will appreciate what a thorough knowledge of essential details means. Later, perhaps, when he helps to put into service a million-foot airship, he will realize this still more keenly. When he stands in the navigating room of the ten-million foot airship of the not distant future, he will act in full confidence in controlling the flight of his huge air vessel because he knows that the ship has always been handled by men who, like himself, were taught their profession in a service which gave full consideration to the basic importance of essential details.

New Era in Motor Performance at Carlstrom Field

The Engineering Department at Carlstrom Field reports that it is getting remarkable performance from its motors; such performance as they believe sets a new record in this line.

Instead of its being necessary to send a motor to the overhaul after thirty-five or fifty hours in the air, it is now possible to get 200 and even 250 hours from the Wright motors being used there. These power plants do not wheeze and cough at this venerable age either; they make up to 1,450 revolutions like the fresh ones, and are as reliable. One motor even shows that it is going to outlast its wings and fuselage.

This remarkable success is attributed to care used in cooling the motors—"jazzing the throttle" while the motor is idling for a landing or on the ground, the ability of Lieutenants Frederick Johnson and Omar Neirgarth, in charge of motors, and the fine work and enthusiasm of the men in the shops.

The above seems the more remarkable when it is remembered that these motors are used for instruction of cadets and student officers.

Practical Rules on Balloon Racing

Colonel Henry B. Hersey, formerly of the Balloon Division of the Army Air Service, and a one time winner of the International Balloon Race, now in charge of the Los Angeles branch of the U. S. Weather Bureau, has summed up the rules for balloon racing in the notes quoted below:

"Watch your statoscope all the time to catch any drop before you get under headway. A few ounces of sand thrown out when statoscope first indicates descent will do more good than as many pounds after descent is well under way. This is especially important if over large body of water in daytime for the nearer you get to water the greater cooling effect on gas and descent becomes more rapid.

"Find the level that gives you a desirable direction and then stick to it as closely as possible but do not let out gas to do this. Valve should not be opened until you have decided to make a landing. If sun expansion takes you up then you have to go, but if you wish to get a lower level again to secure better direction wait for cooling of gas and 'ease down' by dropping just a little less sand than would be necessary to maintain altitude.

"In general if you go to higher altitudes your course will turn to right and if descending will turn to left. This is not so in every case but probably four times out of five. If there is a large field of high pressure over the southeastern portion of the country it will be true in practically all cases. Take advantage of this to get a level that will give greatest distance to eastward without going out over the sea. The St. Lawrence Valley or Maine are good points to try for to get good distance to eastward. You, of course, understand about throwing out paper and watching it change direction as it descends. From this you can see if you would get more favorable direction by 'easing down' to a lower level.

"The most important point of the game is to keep balloon from changing altitude and, to avoid this, watch statoscope and drop just enough sand to check an unintentional descent and no more. All waste matter should be saved in bottles or sand bags and thrown out a little at a time as ballast when needed.

"At night it will be possible and sometimes advisable to keep low, say between 500 to 1,000 feet from the ground but in daytime higher levels must always be taken. From 4,000 to 10,000 feet are usually found to be the best working levels for the daytime.

"You will, of course, carry life preservers of some type. You should have a good hatchet, strong walking shoes, good supply of matches in waterproof carrier, little package of salt in case you should drift up into the Canadian forests and be compelled to tramp out. A light single barreled shot gun and 25 buckshot and 25 bird shot cartridges for killing game would be good to have along. All these things can be thrown out as ballast if necessary in an emergency.

"Very little advice can be given from a purely meteorological standpoint because all plans in this line depend on distribution of atmospheric pressure and other meteorological conditions actually existing at the time of flight and these conditions are constantly changing. You have all taken courses in meteorology and understand the fundamentals of it. Arrange to get the daily weather map from the U. S. Weather Bureau and study the maps very carefully for the few days preceding the race and get the issue for day of race and you will then know just what the weather conditions are and can be guided accordingly."

FOREIGN NEWS

Rumanian Air-Post Stamps

The rapid development of aerial communication is shown, the *Times* states, by the increasing numbers of air-post stamps that are appearing. Rumania, who is responsible for the latest examples, has already issued two separate series in connection with the newly-established air-post service. The first, in very restricted numbers, consists of various current and obsolete postage stamps overprinted "P.A.R." (Posta Aeriana Romana) and surcharged with the new values of two, five, and ten lei. The second series, comprising 5,000 sets of five and ten lei stamps, only bears the inscription "Posta Aeriana, 1920," overprinted in a double-lined rectangle. From the free port of Dantzig come three more air-post stamps, extemporized by overprinting the device of a biplane in flight, or, alternatively, a winged post-horn, on the new German 40 pfg. postage stamp. For the Siamese air-post service a special overprint (or cancellation?), extending over a block of four stamps, is employed. It contains, within a rectangular frame, the Royal emblem of the mythological Garuda bird.

Destroyed Zeppelins: Allies Demand

In reply to a Note from the Conference of Ambassadors to the German Foreign Office, in which the following demands were set out: (1) The German airships Bodensee and Nordstern are to be confiscated to replace the German dirigibles which have been destroyed. (2) The German Government must make good the value of the remaining destroyed dirigibles either in money or by new construction; the Germans state these demands are quite unjustified, as all Entente claims on Germany in respect of alleged violations of the terms of the armistic were settled under the Scapa Flow protocol.

Forthcoming Questions in the British Parliament

Major Glyn.—To ask the Secretary of State for Air, if he will state what was the ration strength of the Royal Air Force officers and other ranks on October 1 last, and what was the authorized establishment; whether officers of the Army are to be attached to the Royal Air Force and for what period; and whether it is intended that a suitable reserve for the Royal Air Force shall be trained, and from what source is it expected this personnel will be drawn.

Major Glyn.—To ask the Prime Minister, whether there is a distinct separate future for the air service, apart from its co-operation with either sea or land forces; whether the expense and duplication of work of the Royal Air Force as at present constituted has been justified by results; and whether the Committee of Imperial Defence has yet had an opportunity of considering the whole future of imperial aerial service and co-operation.

Air Post in Hungary

A daily aerial postal service was inaugurated last month between Budapest and Steinamanger. For the present only letters, postcards, and newspapers are carried.

French Aero Club Announcements

The Aviation Committee of the French Aero Club has fixed the dates for the trials of the Grand Prix de l'Aero Culb as February 20, 21, 22, April 22, 23, 24, and May 20, 21, 22. The text of the regulations will shortly be published. The committee has also appointed a subcommittee to make the arrangements for the Aerial Derby round the world, in agreement with the representative in Paris of the American Aero Club.

British Ministry Announces Plan for Airship Development

In Air Ministry communique 629, the Air Minister announces:

"The Department of Civil Aviation has agreed temporarily to take over all airships, bases and materials, surplus to service requirements, in order to carry out experimental work of an operational character, such as mooring-mast tests and flights of primary importance, to gauge the ships' capacity for commercial operation.

"It is hoped that surplus airships will ultimately be handed over on approved terms to a private company to operate, and the results of these experiments and the knowledge and experience obtained will be available to any such company."

The *Pall Mall Gazette* learns that behind the announcement issued by the Air Ministry lies one of the greatest schemes for the development of commercial aviation yet attempted by any country.

The *Pall Mall Gazette* is able to state that the scheme has for its object the placing of Britain as first in the field in the commercial use of airships.

The vessels to be experimented with are R-36, R-37, L-71, and L-64, all surplus ships. In addition, R-33 is to be temporarily loaned by the R. A. F., whilst sister ships, the R-36 and the R-37, now in process of building, will be available when completed.

The two ships of the L type were recently surrendered by Germany under the terms of the Peace Treaty.

The R-36, 37, and 33 and the L-64 are each of 2,000,000 cubic feet capacity, and the L-71 about 2,500,000.

The last named is able to carry forty tons of fuel, crew, merchandise, and ballast, and the others about thirty tons.

The headquarters for the experiments will be at Pulham, Norfolk.

The first demonstration flights will, it is hoped, be made by R-36 in a few months, the first purpose being to obtain information as to meteorological conditions and possibilities, wireless direction finding, and so on.

The route to be followed will be towards Egypt, the first flight being in the nature of a severe test over part of that route and back without landing.

Conjointly with the operational side experiments will take place at Pulham for mooring test purposes, and the R-33 will be used in this connection.

The possibilities of the airship as a commercial proposition are now, for the first time, to be proved on a large scale.

A recent German experiment, lasting six months, proved an undoubted success. A regular daily Zeppelin service, carrying passengers, goods, and mails, was flown from Lake Constance to Berlin. While it did not result in a big profit, no loss was recorded. Thousands of passengers were carried, and also great weights in goods and mails, and on the occasion of the only mishap no injury to either passengers or crew resulted.

The present scheme of the Air Ministry is designed to prove the full possibilities of the airship as a unit of commerce. That done, it is hoped to hand over the nucleus of a service to a private company, with a sufficient amount of information secured by the experiments to warrant the starting of an organized system of airship trading services to many parts of the world.

As to an Atlantic service for passengers, goods, and mails, it is declared by the experts to be not likely for some considerable time. With bigger ships and more knowledge, however, it will undoubtedly be one of the developments.

It may be recalled that in the spring of this year the *Pall Mall Gazette* announced that negotiations had been opened with a view to forming a huge combine of British aircraft firms to float a syndicate to exploit the airship commercially. The negotiations, however, ultimately fell through.

The Handley-Page London-Paris transport

The H. G. Hawker Engineering Co., Ltd.

With the formation of the H. G. Hawker Engineering Co., Ltd., the official registering of which is dealt with on page 833 under Company Notices, it is exceedingly comforting to see among the list of five directors the names of Messrs. T. O. M. Sopwith, F. Sigrist, and H. G. Hawker.

When it is realized that the Sopwith-Sigrist-Hawker combination was practically responsible for the great name earned by Sopwith aircraft before, and more particularly during, the war, it must certainly come as a blow to all those many pessimists who foresaw with the collapse of the Sopwith Aviation and Engineering Co., Ltd., the complete loss to the aviation industry of those very capable personalities.

France Will Test Air Bomb's Value Against Warships

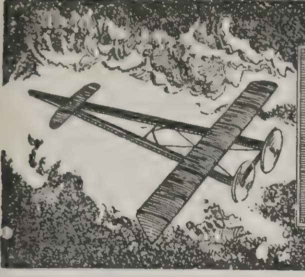
Naval circles are tremendously interested in experiments soon to be carried out by the French navy as to what effect aeroplane bombs will have when dropped on the deck of a fully protected battleship. The British navy was equally interested in the tests recently made in Chesapeake Bay on the old battleship Indiana, but the French experiments, according to reports received here, are to be along lines which will be more indicative of what constructional course Great Britain will follow if it is finally decided that big ships must continue to be built, despite improvements in both submarines and aeroplanes.

The long discussion in connection with the big ship controversy now going on has developed a general belief that the submarines have been conquered. Even the foremost protagonists of capital ships, however, admit that aeroplanes are still an unknown factor in naval warfare.

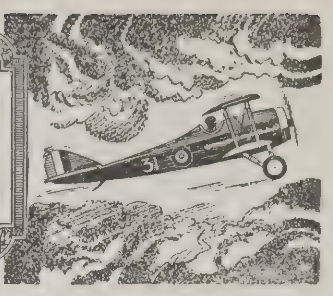
During the war there was but little direct experience which is now of value. One British airman scored a direct hit on the deck of a German torpedo boat, the A-40, lying at a dock. The A-40 was sunk. She was a small torpedo boat and of course her decks were of the lightest steel plates. It was shortly afterward observed that the A-40 was salved without much difficulty and recommissioned as good as new. The records also show one or two merchantmen sunk by air bombs, but it took more than one to finish them.

It is now reported that the French navy is determined to settle the point at the expense of some former enemy warships now in her possession. The first vessel chosen for the experiments is the former Austrian armored cruiser Prinz Eugene, which has a fairly heavy armored deck. Her decks are now being reinforced at the Toulon Navy Yard, and when everything valuable in the way of machinery has been taken off the ship will be towed to sea and the best French aviators called upon to drop their heaviest bombs to find out whether they can score hits under ordinary conditions of combat and what damage the hits will do.

The test is also intimately connected with another naval problem developed at the battle of Jutland and elsewhere. Naval armor has hitherto been the heaviest about the belt. In the last conflicts this fact has been met by the development of the art of high-angle fire, which brought down shells plunging vertically upon the lesser protected decks. Some of the severest casualties sustained upon either side in the Jutland fight were caused by shells piercing magazines, thus destroying the battle cruisers more effectively than by the use of torpedoes.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



A Scale Model of the Verville Racing Biplane

THE drawing given below illustrates the method of constructing a flying model of the Verville Racing aeroplane which won the Pulitzer Trophy on Thanksgiving Day. American model builders should be interested in building a replica of this successful design as it is purely an American job throughout, including the 600-H.P. Packard engine.

The body will probably be a little difficult to build as it requires the use of a carved block of balsa wood. In the detailed description which we will give of this plane, instructions will be given for properly carving out the body. The wings are of rather simple construction being built up of a single wing spar and a single strut between the wings.

It is desirable to redraw the outlines at full size, for in this way the builder can obtain the true proportions.

The finished machine should be painted similar to the real plane in order to make the best appearance. In the Verville-Packard, the wings are a yellowish brown, the body and fin of light gray and the cowling in the region of the engine of natural aluminum. Of course, the red, white and blue insignia on the tail identifies the plane as an American design.

If properly made and all instructions carried out with care, the Verville model should fly more than 100 feet, showing a high speed in satisfactory proportion to the original machine, the fastest American aeroplane ever built.

Below is a list of the dimensions:

Wing span	32″
Overall length	24″
Overall height	9″
Wing Chord	6″ to 3½″
Wing gap	4¾″
Propeller (diameter)	10″
Wheels (diameter)	2″

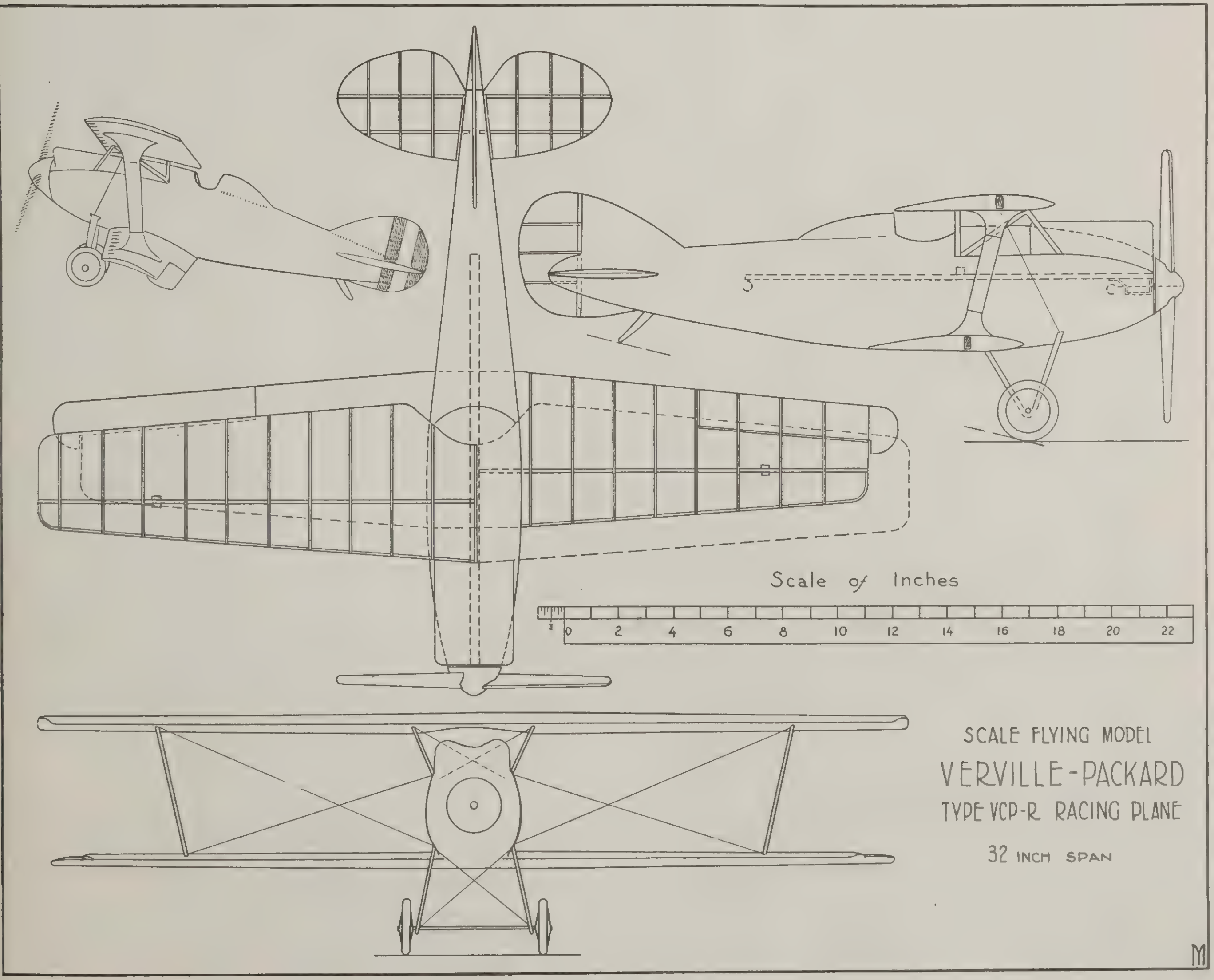
In the next issue of AERIAL AGE we will begin the detailed description of the various parts, telling how to make and assemble the model.

(To be continued)

Flies With Ford Motor Plane

E. F. Komm, of Yakima, Washington, has had successful results in building and flying a Ford-motored aeroplane similar to that described in these columns. The Ford cylinders were rebored 3/16 inch oversize and valve diameters were increased ⅛ inch; ports also bored. Force-feed oiling system, Dixie magnetos and Zenith carburetor were used.

The wings have a span of 24 feet; chord, 4 feet; incidence, 3½ degrees; weight, 480 pounds. The machine climbs well and has a slow landing speed. Normal speed, about 55 miles an hour.



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The X Y C's of Aeroplaning

Don't worry whether there is gasoline in the tank or not, but if you must know, investigation with a lighted match will usually tell.

If your engine gets too hot an ice pack properly placed will allay the fever.

Punctured tires may be quickly repaired by a few mouthfuls of Wrigless Gum.

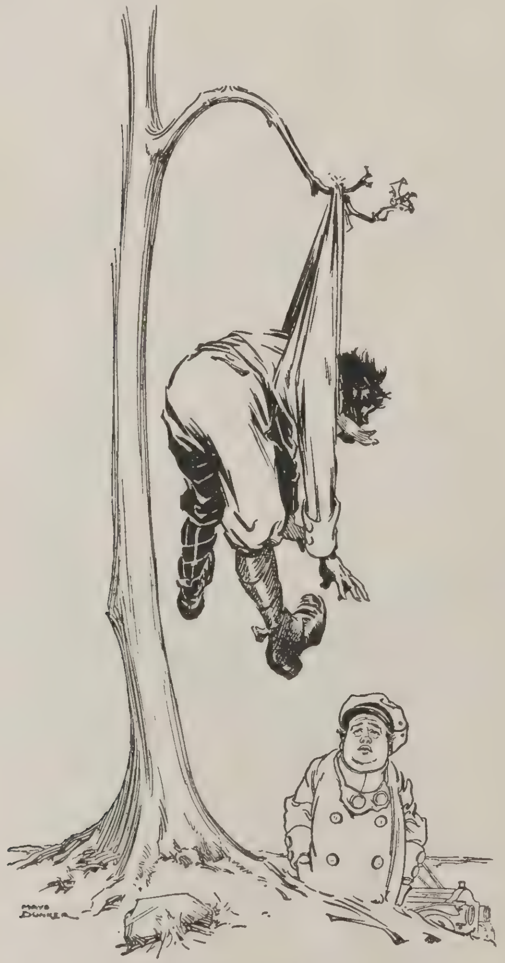
If your self commencer works, don't be alarmed. Accidents will happen.

A properly set speedometer will increase the speed of your machine enormously.

Soft tread tires will enable you to land safely on rough ground.

When you put your engine together be sure to leave a few parts out for extras.

If you have trouble starting your engine on winter mornings, let it run all night.



IN KANSAS.
"Cyclone?"
"No; aeroplane."

Within Her Rights

A woman mounted the steps of the Chicago-New York airship express, carying an umbrella like a reversed sabre. An attendant touched her lightly, saying:

"Excuse me, madam, but you are likely to put out the eye of the man behind you."

"Well, he's my husband!" she snapped.

Blissful Depravity

In a border southern town lives an elderly negro carpenter who is locally distinguished for his use of large words and his abiding fear of his wife, who is big, impressive and domineering. In this town a trio of young aviators keep bachelor quarters.

Not long ago one of the three called the darky in to do some small repairing.

"Boss," inquired the old man, in the midst of his work, "does you white gen'l'mens live heah in total depravity of de feminine sex?"

"We do," was the answer.

From the bottom of his henpecked soul the old darky fetched up a long, deep, sincere sigh.

"Well, suh," he said, "ef I wuz ez you is, I should suttinly remain so."

Got Out of It

Very proud in his new khaki uniform, the National Guard airman was walking around camp, and went to the butts, where some soldier lads were trying to hit a bull's-eye, but repeatedly missed.

"Here, boys," called out the officer, "I'll show you how to shoot." And he took a rifle, and missed. Having a good strain of Irish blood in him, his wits quickly came to his aid, and he smilingly remarked:

"That's how you shoot."

Taking a steadier aim, he fired again, and this time exactly pierced the bull's-eye.

"That," said he, triumphantly, "is the way I shoot."

Knows No Master

"I understand you have an aeroplane now," said the neighbor. "Do you drive it yourself?"

"No," responded Mr. Suburbs sadly; "nobody drives it. We coax it."

Very Good, Eddie

He—My father has just sent me an Airedale—shall we take it out for a run to-morrow afternoon.

She—Oh yes! Let's!—I just love to ride in those foreign cars.

When driving in his aero
The two could not agree;
She must have crowded him,
For she said, quite saucily,
"You cannot work the clutch with me
In here, my dear!"

As It Seems to the Aeroplane Owner

So gasoline is going up?
The price gives me a pain,
Oh never mind we'll just drink oil,
And feed the bus champagne.

The Don't Worry Club

"What has become of that 'Don't Worry Club' you once helped to organize?" said the helper to the air pilot.

"Everybody refused to worry. The club got in debt and had to disband."—*Baltimore Sun.*

AEA.

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AERIAL AGE

WEEKLY

12, No. 16 DECEMBER 27, 1920 10 CENTS A COPY

Photo by U. S. Army Air Service

Airscape of the U. S. Naval Observatory

Annual Report on the Aerial Mail Service

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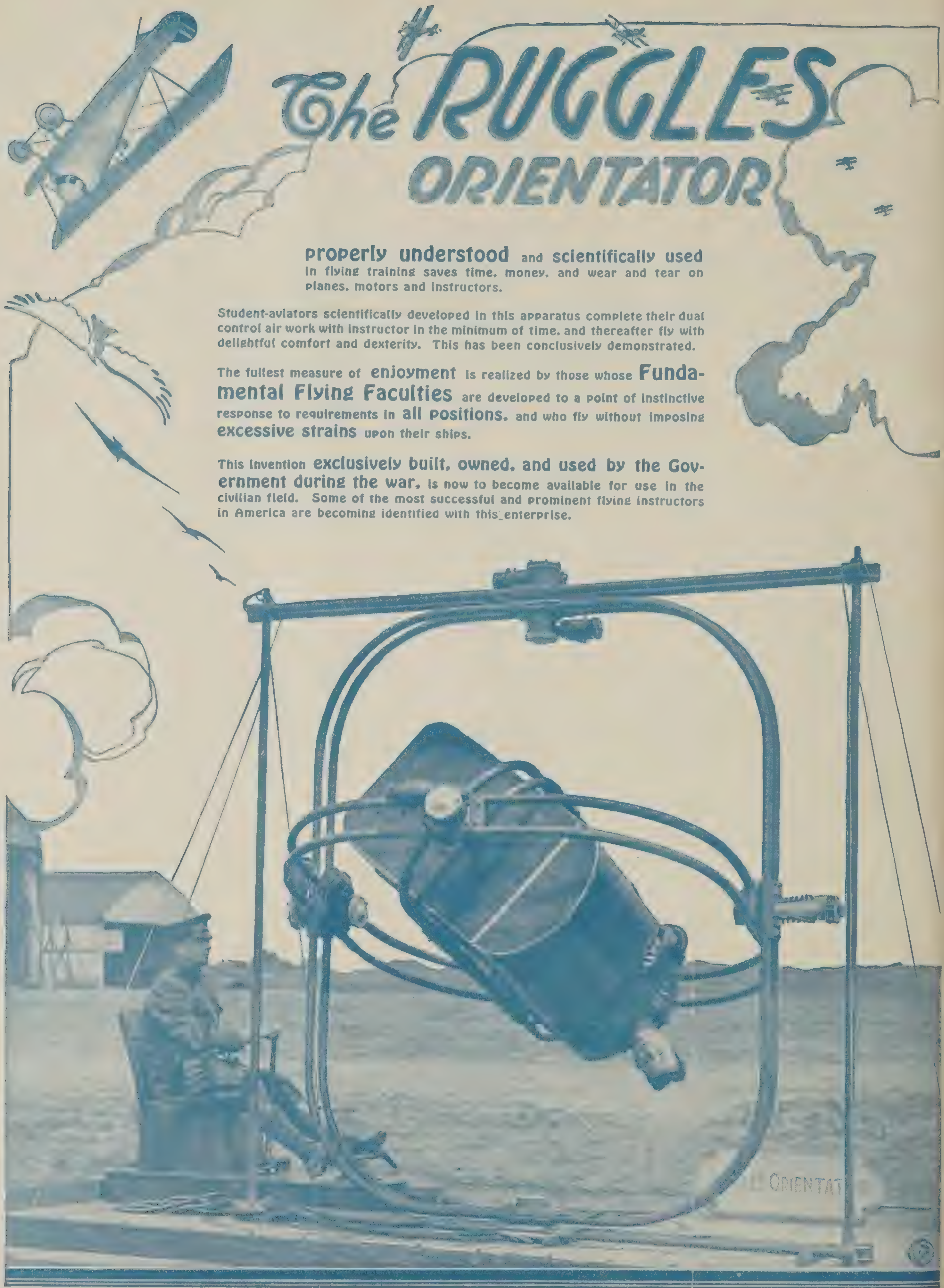

The RUGGLES ORIENTATOR

properly understood and **scientifically used** in flying training saves time, money, and wear and tear on planes, motors and instructors.

Student-aviators scientifically developed in this apparatus complete their dual control air work with instructor in the minimum of time, and thereafter fly with delightful comfort and dexterity. This has been conclusively demonstrated.

The fullest measure of **enjoyment** is realized by those whose **Fundamental Flying Faculties** are developed to a point of instinctive response to requirements in **all positions**, and who fly without imposing **excessive strains** upon their ships.

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ANNUAL REPORT ON THE AERIAL MAIL SERVICE

IN the course of his Annual Report to Congress, Postmaster Burleson dealt at length with the Aerial Mail Service.

After pointing out that this service had operated during the year with increased efficiency, increased saving in car space, and greater expedition of the mail through the extension of the mail to additional commercial centers, the report goes on to point out future possibilities. It states: "There are still on hand in this country thousands of planes, obsolete for military purposes but which can be adapted to the carrying of the mails and which will be ultimately rendered useless through deterioration in storage if not put into service by the Post Office Department. Aside from the progress made in developing military planes, the tendency in aviation has been toward the creation of types that will carry greater loads at less expense and with longer cruising radius, so as to eliminate intermediate stops for gassing. The greatest advance in this direction was made in Germany, and when a small number of German planes were introduced in this country the Post Office Department, together with other governmental activities, purchased some of these planes for thorough testing in daily operation. The planes are all metal, built of a light aluminum alloy, which carry 1,000 pounds commercial load with 240-horsepower motor and have a cruising radius of six to seven hours on low-grade fuel, as against the salvaged war planes in the Mail Service which carry 400 pounds of mail with 400-horsepower engine and have a cruising radius of three hours with high-test gasoline.

"They offer a solution for commercial work by reducing the cost of operation probably 50 per cent. Their introduction into this country has turned the attention of American manufacturers to the building of planes of greater economy of operation, and their tests by the air mail have furnished information that will enable the Post Office Department to utilize some additional discarded war-training planes. These salvaged war planes that are now being prepared for the mail service will carry 600 pounds of mail with 240-horsepower motor and have a cruising radius of five hours. The utilization of these planes will cut the operating cost about 40 per cent.

"In addition to the direct operation of the transcontinental air-mail route and its feeder lines, the Post Office Department under the law has let a contract for carrying the mail by seaplane between Key West and Habana and by land plane on the following three routes:

(*A*) Between New York and Atlanta, via Washington, Raleigh, and Columbia, a distance of 815 miles.

(*B*) Between Pittsburgh and St. Louis, via Columbus, Cincinnati, and Indianapolis, a distance of 600 miles.

(*C*) Between New York and Chicago, via Harrisburg, Pittsburgh, and Fort Wayne, a distance of 735 miles.

The mail in each of these cases will be expedited by from 12 to 16 hours, and the contracts for the land routes on advertisements for bids were let at prices within the amounts that will be saved on transportation of these mails by railways. A contract has been let from October 15, 1920, to June 30, 1921. for a route from Seattle to Victoria, British Columbia, to connect with the steamer which left Vancouver on the day previous, and thus dispatch between 12,000 and 14,000 letters to the Orient with a saving of time equal to the elapsed time before the departure of another steamer.

"The Postmaster General has from time to time urgently recommended to Congress a fuller development of the Air Mail Service. The plan of the Department has been not only to establish this expeditious service between the principal commercial centers but to connect them with the gateways on our seacoasts and on our northern and southern boundaries in order to expedite mail to foreign countries. Notwithstanding that the business interests of the various large communities were keenly alive to the importance of this expeditious mail movement and were willing to contribute heavily to the establishing of air-mail fields and hangars, Congress failed to respond to these recommendations in a manner that would have enabled the Department to better meet the needs and demands of the important cities. Not only have the business interests of the country urged and supported the proposed comprehensive air mail, but the military authorities have given it enthusiastic support as a peace-time nucleus which the country would need seriously in the event of war.

"In a study of the question of encouraging civil aviation the General Staff of the Army points out the economy of developing commercial aviation in time of peace as a foundation for sudden and large expansion in time of war, and sets forth the impracticability of making immense appropriations for military aviation in times of peace in order to enable the military service to speedily cope with a war situation.

The Post Office Department has endeavored to point the way to practical commercial operation of airplanes in its operation of the air mail, and it has brought the work to the point where it will be possible to make contracts with commercial enterprises for carrying the mail in connection with passenger and other traffic. It recommended legislation that would permit the Department to make such contracts, but Congress responded to this in an insufficient manner by the adoption of a provision in the law which requires that contracts for mail by airplane shall not result in a greater cost for transportation of the mail than by train. This restriction takes no account of the greater expedition of the mail by plane service over train service. The Post Office Department has investigated the possibility of contract air mail service between a number of cities, which service would expedite the mail over existing train schedules, but not at a less cost than by train.

"One of these investigations covered a proposed route between St. Louis and Kansas City, which would connect the latter city with the air mail system at St. Louis. Although it would mean a great saving in time, it was not found possible to let this contract because the cost of this transportation would be greater than by train. The same situation was found on investigation of the mail service between New York and Norfolk. Letters mailed in New York City which cannot be distributed in time to catch the southbound train leaving New York about 8 P. M. cannot be delivered in Norfolk until the second day owing to schedules of train operations. By taking this mail from the train at Baltimore and carrying it by seaplane over Chesapeake Bay the letters could be delivered in Norfolk on the morning following their mailing in New York. However, no saving in transportation by train could be made by such an airplane contract, and the law not taking into consideration the expedition of the mail, the Department could not provide this greatly improved service between the two cities.

"These are only a few of the important mail possibilities investigated by the Department. The law should be amended so as to permit the making of contracts for carrying mail by airplane, even at increased cost over train service, considering the commercial benefits to be derived from the greater expedition of mail. In addition to amending the law so as to permit of a more liberal contract service I urgently recommend that the system of Government routes be extended as follows: Boston to Detroit, via Buffalo; Chicago to Los Angeles, via Kansas City; St. Paul-Minneapolis to Seattle; and St. Louis to New Orleans, via Memphis."

THE NEWS OF THE WEEK

Flying Ordinance Being Prepared for New York City

F. H. La Guardia, President of the Board of Aldermen, has announced that he is preparing an ordinance which will be introduced in the board for the regulation of air traffic over the city of New York.

"With the increase of flying over the city and the establishment of great aviation bases in this vicinity," said Mr. La Guardia "it becomes absolutely essential that measures be taken for the protection of the lives of the residents. So far within the city proper we have had no serious disasters from the operation of aircraft over the city, but it is impossible to say when such a thing might occur. That it will occur with the rapid growth of air traffic is inevitable unless precautions are taken now to prevent it.

"The full provisions of the proposed ordinance are not yet complete, but I am in conference with men conversant with flying and flying regulations and the details are being worked out.

"Of course a primary requisite of such an ordinance must be that it requires aviators in flying over the city to fly at a sufficient height to permit the machine to glide to a clear and safe landing in event a forced landing should become necessary. I am of the opinion that a height of 3,000 feet should be made compulsory over the Borough of Manhattan, while over Brooklyn and the Bronx a greater altitude should be required. At least 5,000 feet should be the limit in the latter boroughs.

"A lower altitude is permissible over Manhattan for the reason that this borough is surrounded by water which from no position over the island could be at a greater distance than could be reached by a plane gliding from an altitude of 3,000 feet. Open water or other landing places are not so convenient for aviators flying over the heart of Brooklyn or the Bronx, and it is necessary, therefore, that a greater altitude be required over those boroughs.

"Suitable regulations must be made against 'stunt' flying over the city also. The aviator should not be allowed to take any risks which might add to the peril of persons on the ground.

"It is anticipated that some difficulty may be experienced in enforcement of such an ordinance, and for that reason penalties should be made very severe, so that the prospect of the penalty itself will make the risk of escaping detection or identification too great to be undertaken. It is possible in nearly all cases to identify an aeroplane.

"There probably will be some opposition to some of the provisions incorporated in the ordinance. For instance, the altitude requirements are likely to interfere with the making of photographs of the city or buildings from the air, and aerial photographers might reasonably be expected to wish the law otherwise. Where responsibility for the lives and safety of the residents are concerned, however, it will be necessary to combat such suggestions for the amelioration of the regulations."

Tennessee National Guard Air Unit

Authority has been received from State Adjt.-Gen. Sweeney to proceed with the organization in Chattanooga of a unit of the Tennessee National guard air squadron, the third unit to be organized within the state. The other two units, completing the squadron, are located at Memphis and Nashville.

Authority to organize a unit here was received from Gen. Sweeney by R. I. Brown, head of a local flying company, who is also interested in aviation aside from its commercial value. Mr. Brown stated that he would proceed at once with the task of perfecting the Chattanooga unit and hoped to have it ready for inspection by federal officers within the next month.

The unit will consist of thirty officers, forty cadets and 192 enlisted men. New hangars are to be built at Marr field, said Mr. Brown.

According to Mr. Brown, opportunity will be given men who enlist to learn to fly, to study gasoline motors, magnetos, carburetors and everything pertaining to motors. Wireless, map drawing, observation, machine gun and other studies relative to the training of an aviator will be taken up.

The new unit will have army training planes, cars, trucks and motorcycles and other material which will give this unit a full army air service equipment. Men are eligible to join from the age of 18 to 40, and for a period of one year.

As soon as federal recognition is obtained, officers will receive approximately one-fifth regular army pay. Compensation will also be allowed enlisted men under national guard regulations.

This aero squadron is the second national guard squadron to be organized in the United States. The state of Michigan is the only other state promoting the idea. It has a squadron recruited to full strength and it is said it is obtaining unusually good results.

Chicago Air Ordinance Planned

Chicago.—An ordinance providing Chicago's first air traffic rules for aviators flying over the city has been prepared under the direction of the Aviation Committee of the City Council for submission to the council.

Among other things it provides for imprisonment in jail up to six months for any aviator who attempts to do "stunts" over the streets or buildings of the city. It also requires aeroplanes to keep at a certain height while passing over the city.

"No aeroplane," the proposed ordinance states, "shall operate in the city at a less height than will permit forced landing outside the city, or in a landing field open to public use, or in a clear, open field."

Annual Meeting Cincinnati Aero Club

Thursday evening, December 2d, the Aero Club of Cincinnati held its second annual meeting at the Metropole Hotel. It was a well-attended affair and was preceded by a dinner at which Col. Peter E. Traub, Commandant of Ft. Thomas, was guest of honor. Colonel Traub and Miller Outcalt (member) related various thrilling overseas experiences in which the Air Service played a great part. The coming of the air mail to this city was discussed by a member of the Aviation Committee of the Cincinnati Chamber of Commerce who accompanied Mr. Lawson around the city on his last trip here. The dinner and social events were followed by a business meeting and the following officers were elected for the year of 1921: John H. Stewart, president; Cornelius Hauck, first vice-president; Mark Campbell, second vice-president; John M. Renner, treasurer; John E. Hendrixson, secretary; L. B. Cahill, Jr., Fred Macklin, Bayle Richardson and H. W. Landmead as directors.

Personal Pars

Capt. A. C. York is Chief, Officers' Section, Administrative Group, Personnel Division, Office Chief of Air Service, Washington, D. C.

Capt. Arthur R. Christie, Air Service, is promoted to Major in the Regular Army, with rank from July 1, 1920.

Long Beach to Stage Aviation Meet

March Field has been asked to participate in the National Winter Air Tournament to be held at Long Beach, December 25, 26 and 27, under the auspices of the Aero Club of Southern California. Sanction of the meet by the Aero Club of America is awaited by officials of the local club. Walter Hempel is in active charge of arrangements.

The meet is to have a three-fold purpose. There will be a ground exhibition of various type planes, practical demonstrations of the commercial uses and possibilities of aircraft and a number of races and other speed and endurance contests in the air.

Co-operation has been promised from the army and navy, and it is expected that the government exhibits will play an important part in both the flying events and demonstrations.

Dougherty Field, the new Long Beach aerodome, which is nearing completion, is sufficiently large to accommodate more than a hundred planes, and smooth enough for the fastest racers to use with all safety.

Entry blanks have been mailed to prominent fliers in all parts of America, and efforts are being made to bring from the east the racing planes which represented America in the Gordon Bennett contest in France in September and in the Pulitzer Trophy race at Mineola, L. I., on Thanksgiving day.

In the lighter-than-air-craft field the navy will display at least one dirigible and kite and spherical balloons. Ross Field at Arcadia will be called upon for observation balloons. The Goodyear company will also be in the field with a blimp or two. Seaplanes of various types will be displayed by the navy.

Lighter-Than-Air Force Enjoying Their Training at Royal Airship Station

An interesting letter was received a few days ago from one of the boys who trained in the lighter-than-air department at North Island, and who was selected among the large number to go to England to receive advanced instruction in the handling of the rigid type of airship. The entire crew is in charge of Commander Lewis H. Maxfield, who is a pioneer in the lighter-than-air activities. Many of the enlisted personnel received their training here under the direction of Lieut. Roman J. Miller.

It is the intention of the commanding officer to have all the riggers experienced in handling the big ship the R-38 and to be able to handle the controls.

One of the great experiences of the men was when they made a trip over London to welcome home the Prince of Wales. The R-32 was making about 60 knots an hour, and as the R-33 was also in the air the men took turns on watch on top of the big ship, and it was a great experience. The ship flew over the U. S. S. Pittsburgh that was in dry dock at Chatham, and thence they followed the Thames to London. Great fogs make flying rather dangerous, and it is necessary to have a man on watch constantly on top the ship. To be standing on the lookout bridge of the big blimp making sixty knots and better is sure some sensation and thrills are plenty.

Dirigible Line to Catalina Island First to Be Started in West

The line known as the pony blimp passenger service operates between Los Angeles and Avalon, the city of the magic isle, and has proved a success. The trip is made in a direct flight of 60 minutes—two hours shorter than the usual journey by rail and water. The aerial jaunt offers an opportunity to view Avalon harbor and the entire island from an elevation from which their picturesque beauty may be better appreciated. "Landings" at Catalina are made on the water, and passengers disembark on a large mooring raft in Avalon bay, from which they are conveyed to shore in speedy motor boats.

The midget dirigible has become a regular western institution and its activities have been heralded throughout the entire country. The pony blimp has covered over 12,000 miles since the new line was started.

The inauguration of this first regular lighter-than-air passenger service marks a new epoch in aeronautics in this country, and its successful progress is being watched by the friends of aviation everywhere.

Radio and the Stock Market

For the first time in the history of Wall Street the wireless telegraph supplanted the ordinary telegraph lines Dec. 14 in carrying on of stock market operations between this city and Chicago. The wire lines were disrupted by the storm early in the morning and during the final hour of trading on the New York Stock Exchange W. J. Wollman & Co. conducted business with Clement, Curtis & Co. of Chicago by wireless. The plan worked with such perfection that W. J. Wollman, who instituted the new procedure, stated that it was a tremendous step forward and precluded New York being isolated from the rest of the country because of storms which would put the telegraph lines out of commission.

The arrangement for the service was made hastily with the Intercity Radio Communication Service, which will operate wireless between New York, Cleveland, Detroit and Chicago.

Fiume Aviators Invade Italy

Rome.—Aviators from Fiume have been repeatedly allowed recently to fly over Italian towns, dropping propaganda leaflets. They have gone so far as to use an Italian aerodrome for refurnishing their fuel.

One Fiume aviator flew over Parliament buildings and dropped a message calling for the conclusion of the Italian-Jugo-Slav treaty at Rapallo, afterward obtaining a supply of gasoline for the return journey to Fiume.

On the journey home the aviator encountered engine trouble and was forced to land in San Marino, the little republic with about 7,000 population, within the boundaries of Italy.

Down-town New York in the Twilight

The AIRCRAFT TRADE REVIEW

Aircraft Sales Takes Over Pan-American

The Aircraft Sales and Service Company organized with offices at 514 Lyric Theatre Building, Cincinnati, Ohio. This company has taken over the interests and equipment of the Pan-American Aeroplane Exchange and will carry on an aeronautical brokerage similar to that of the Pan-American but will have a more complete service and act as booking agent for some of the leading aerial transportation and educational institutions of the country.

Caproni's Plans

Rome.—King Victor Emanuel was keenly interested when he was told by Gianni Caproni, the aeroplane inventor, of a projected giant plane which would carry 300 persons across the Atlantic in about 36 hours. Plans for the machine are now being completed and provisions are being made for dining and sleeping accommodations on board the aerial liner.

A smaller aeroplane, designed by Signor Caproni, will make its first trial trip in January at the Caproni factory near Lake Maggiore. This aeroplane will be capable of carrying 100 persons a distance of 500 miles, it is said. Work on the transatlantic plane will be started as soon as this smaller liner has been tested. During his conversation with the King Signor Caproni told him of his plan to return to New York next spring and begin the construction of a new aeroplane factory near New York City.

Several interviews between Signor Caproni and Colonel James Chaney, aerial attaché at the American Embassy here, have been held, and the inventor has met other officials of the Embassy.

Aeroplane Versus Rail

New York.—Sixteen hours and thirty minutes flying time to Florida, as against 48 hours continuous travel by rail, was made by the Aeromarine Navy Cruiser "Christopher Columbus," according to telegrams received December 13th from Miami, Fla., by the Aeromarine Plane & Motor Company. The 14-passenger flying boat left New York City on the morning of December 10th. It is one of a fleet being operated by the Aeromarine West Indies Airways, Inc.

Complete Goodyear Reorganization Plan

The plans for the reorganization of the Goodyear Tire and Rubber Company have been practically completed and will be submitted to the stockholders for their approval at a special meeting called for December 24. Those plans, it is understood, call for a capitalization of $100,000,000 of 7 per cent. preferred stock of $100 par value and not to exceed 1,500,000 shares of common stock without par value. The stockholders will also be asked to authorize the issuance of not more than $50,000,000 of bonds or notes bearing 8 per cent. interest and running for twenty-five years.

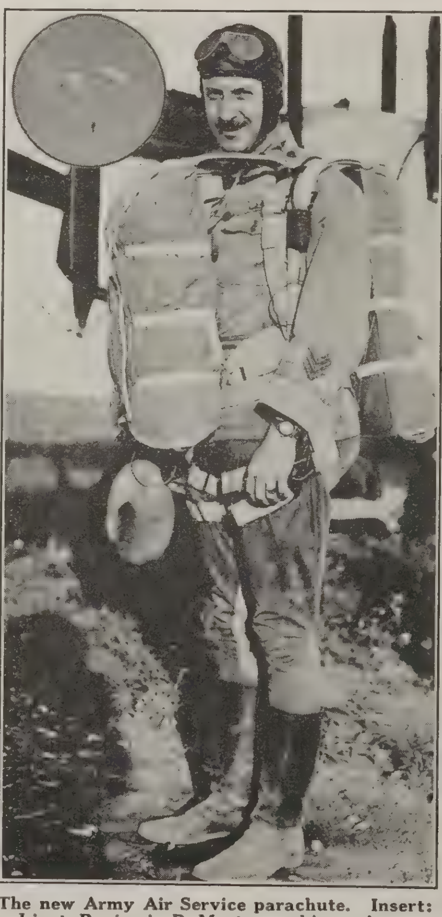
The new stock, both common and preferred, is to be exchanged for the present outstanding issues, share for share, according to a circular sent to the stockholders. The holders of the new preferred stock will have exclusive voting rights in the company or the right to elect a majority of the board of directors.

G. M. Stadelman, vice-president of the company, has announced plans for the reorganization of its treasury department. W. E. Palmer has resigned as treasurer of the company, but retains the office of secretary, he said, and H. J. Blackburn and H. H. McCloskey have resigned as assistant treasurers. R. Jackson becomes treasurer, with C. L. Weberg and P. H. Hart as his assistants, the three representing the firm of accountants which is acting on behalf of the financial group that has undertaken to straighten out the financial affairs of the company.

S. A. E. Annual Meeting

At the annual meeting of the Society of Automotive Engineers, which will be held in New York City, January 11-13, two sessions will be given over to the discussion of aeronautic problems. The first session on Tuesday evening, January 11, will consider the recent engineering developments in aircraft, such as variable camber wings, metal construction, internally trussed wings, retractable chassis and propellers. The second session in the evening of January 12 will consider the development of commercial aviation using both lighter and heavier-than-air types, with a presentation of the progress of air transport in Europe and a study of its future possibilities in America.

All of the other sections of the Society will have their usual sessions, and the annual banquet will be held at the Hotel Astor on the evening of January 13.


The new Army Air Service parachute. Insert: Lieut. Benjamin R. Morton making a jump

London-Paris Air Mail Stops

London.—The Airco Company, which has been operating an aerial mail and passenger service between London and Paris, has been compelled to abandon operations.

Since its inception the company has transported 5,000 passengers across the Channel, and it had been thought that it was prospering on account of its large business.

Book Review

It is a curious fact that the older mechanical means of transportation and the newest one—railroads and aviation—suffer in similar manner from the same serious difficulty. The tracks of the railroads are in reality little used throughout the twenty-four hours; the ambient air offers innumerable pathways. But earth and air are both short on terminals.

The object of this small but very suggestive book is to show that the problems of the day in commercial aeronautics are summed up in the creation and administration of flying routes and landing spaces, particularly the latter. The flying industry cannot use clouds for garages. It must have a *pied a terre*.

With universal resort to the air as safer than the highways, and growing desire for proper aerial road houses, increasing emphasis will mark the novel wants outlined by the various authorities whose experienced views and careful suggestions are here set forth. A surprising list is presented of no fewer than 1,348 towns and cities in the United States where exist landing fields—emergency, ordinary, municipal or governmental. Of these forty-five are under the control of cities or chambers of commerce.

The argument is boldly advanced by some of the contributors that municipalities of ambition should at once get into the game. When it is remembered how poorly the usual municipal business enterprise is run and how often it is besmeared with graft in its politics and incapacity in its management, the public will be slow to become enthusiastic over this latest candidate for funds to be furnished from taxation.

The necessity is apparent, but can be met in other ways. Incidental costs can doubtless be minimized with aeroplanes whose design—like that of the helicopters—tends toward lessening the "runway"; but it gives one pause to note that "a ship of the R-34 type needs at least 1,000 acres of clear ground in order to manoeuvre properly." Quite a little real estate speculation there!

MUNICIPAL LANDING FIELDS AND AIRPORTS. Edited and Compiled by George Seay Wheat. G. P. Putnam's Sons.

THE LAWSON MIDNIGHT AIRLINER

THE new Lawson Midnight Airliner which has just been completed at the Lawson Airplane Company's plant in Milwaukee, Wis., contains a large number of new features in aeroplane design and construction.

This ship, like all of its predecessors built by the Lawson Airplane Company, was designed by Alfred W. Lawson, who has already brought out eight distinct types of aeroplanes during the past five years.

This mammoth ship, which is designated in the series of airliners already built or now in course of construction by the Lawson Airplane Company, is technically known as the "L-4."

In designing the Midnight Airliner, Mr. Lawson brought out a ship which can be either used for passenger carrying or mail carrying purposes and can also be changed from a night ship with sleeping berths to a day ship with chairs within half an hour.

Some of the special features which the new ship contains and which might be particularly interesting to call attention to at this time are as follows: the captain and pilot's house, which is walled off separately from the general cabin, contains a collapsible seat for the pilot whereby he can either thrust his head out through an opening in the roof of the cabin and thereby have a clear and unobstructed view from the outside, or he can lower his seat a foot and a half and, by closing the aperture in the roof with a slide provided for the occasion, he can then be enclosed entirely within and see to steer the ship through windows all about this pilot's cabin. There is a dual control in this cabin which is operated by both the captain, who will act as navigator, and the mate, who will act as pilot or steersman, as it were.

Besides having sleeping berths for the passengers in the regular cabin, there is also a toilet room which has all of the ordinary accessories of a Pullman railway car plus a shower bath, which Mr. Lawson has installed for the use of fastidious passengers who may want to pay an extra price for such a luxury.

Just back of the cabin is located the United States Mail Department in which Mr. Lawson has designed a mail chute whereby mail can be either put on or taken off while the ship is in flight.

A more or less technical description of the Lawson Midnight Airliner is as follows:

Body

The pilot's cabin is separated from the main cabin by a double hinge door in which is placed a beveled glass window so that either pilot or navigator may see into the passenger cabin or vice versa, and also talking tubes are placed through this door so that the captain or pilot may talk directly to the engine man and mechanic, who sits in the first seats of the regular cabin.

In front of the controls is a mahogany dashboard equipped with a complete set of instruments, such as three sets of Delco Boosters, tachometers, oil pressure gauges, and water and oil thermometers. There is also a clock, barometer, air-speed indicator, vertimeter, lateral and longitudinal inclinometers. A word might be said of the tachometers. Due to these being installed on the dashboard in the pilot cabin, the shafts that run to the engines are attached to right angle reduction gears, which drive the long shaft one-fourth crank shaft speed, a large factor in preventing shaft whipping or breakage where directions of drive take place. These shafts, as well as the air, oil and water thermometer lines, run through streamline cases between the body and the nacelles.

Between the pilots, and mounted on top of an aluminum pedestal, are the throttle levers so arranged that any one or all motors can be controlled at the same time. On the face of this pedestal and about four inches below the top is a hand-wheel for operating the trimming plane. The throttle controls are positive throughout the entire system, being composed of steel tubing, which rotate or push and pull, as the case may be.

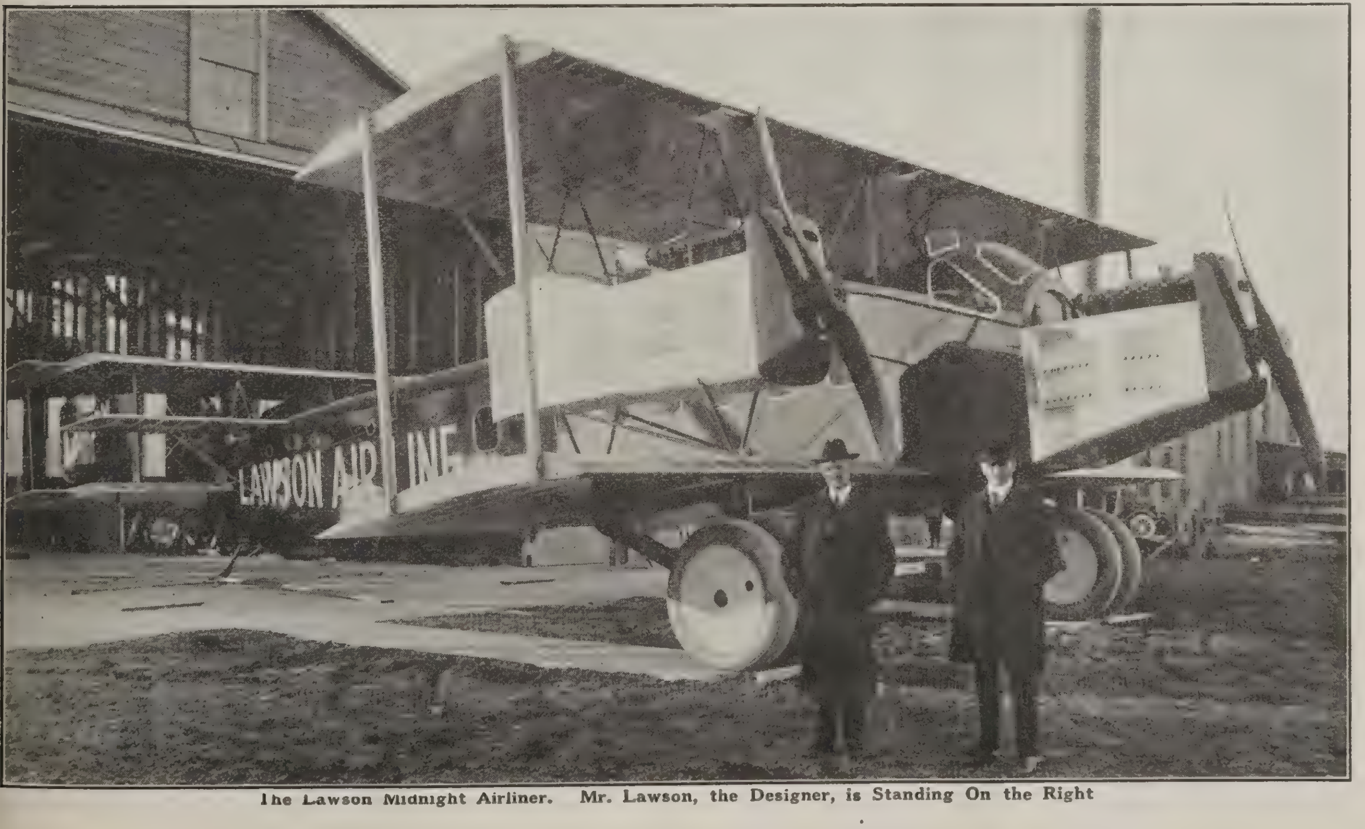
Dep control is used. Instead of the usual chain-drive, bevel gears rotate a vertical shaft running through the main column, which has a pinion at the base driving a rack. On the outer ends of each rack the aileron control cables are attached, these running directly out to the wings after passing over large directional pulleys.

The elevators are operated by doubled cables running under the floors on the left side of the body to a rocker shaft placed on the top longeron in back of the cabin. Several inspection doors are placed on the floor of the cabin for these as well as the rudder cables, which also are arranged similarly to the elevator control cables.

On a separate dashboard overhead and between the pilots are placed the switches. Near the seats are placed fire extinguishers.

A mechanic dashboard is placed in the front end of the main cabin on the right side. This is equipped with air pressure gauges and an air distributor tank into which the air is pumped from the engines for the air pressure gas system and properly distributed to the respective gas tanks. This tank is always primed, so it is an easy matter to start all three engines. Alongside of the dashboard are the ignition control handles for advance and retard, these being push and pull rods to all motors.

The cabin itself is of the convertible type, having attachments for twenty-six seats, berths and mail compartments.



The Lawson Midnight Airliner. Mr. Lawson, the Designer, is Standing On the Right

When used as a day machine all twenty-six seats are installed, and when used as a sleeper there are six seats and berths. These latter are the disappearing type and can be extended within a few minutes. The machine carries a complete lighting system for dashboard, cabin lights, wing and tail lights, and a large searchlight and a heating system. At the rear end of the cabin, and on the right side of the machine, is located the main entrance door. Directly across from this door on the right side of the machine is a complete bathroom, the first ever installed upon any aeroplane. There is a shower bath, washstand and towels, mirror, drinking water and lavatory. A large overhead water tank, of both hot and cold water, is used for the shower, while the tank containing ice water is used for drinking purposes. The whole compartment is white enameled, with white rubber draw curtains on the windows and entrance, while the floor is tiled.

Behind the bathroom is a mail chute and baggage room. This is reached through a door, which also allows entrance for inspection of the rear end of the body. An inspection walk runs from this door to the stern.

Constructionally, the body is composed of spruce longerons the entire length. These are pin-jointed at the front, allowing a complete removal of the whole front engine with its controls and attachments, radiators, etc. The longerons are again jointed immediately behind the rear end of the cabin, thus allowing the whole tail to be removed and a new one installed, thus facilitating little wastage of time in making repairs.

The complete cabin section is composed of laminated spruce bulkheads, with the grain of the wood running according to the direction of the loads, thus allowing greatest strength for least weight. The cabin is completely covered with veneer, with light stiffening pieces. The windows are of safety glass, while those in the pilot cabin are of celluloid, due to the convex curves of this section. The rear end of the fuselage is standard construction, having spruce struts and cables, and is linen covered. At the extreme rear end and around the tail-plane and tail-skid section the body is again covered with veneer to stiffen this portion and prevent twisting.

The interior of the cabin is finished in mahogany and cream and is covered with a heavy carpet, while the outside is enameled green throughout.

When used as a mail machine, mail compartments are installed in place of all but six of the usual passenger seats, thus allowing passenger carrying as well as mail and cargo. This is the only change found necessary for this conversion.

Wing Structure

There are five sections in the upper and four on the lower, each hanging to the other and to the body. They are of the usual construction, consisting of two spars of I section spruce and laminated in two pieces with hardwood strips top and bottom. The ribs are of the girder type and are of spruce material throughout. All ribs are of standard section, there being no special ribs in the whole structure. Square spruce struts carry the compression. The engine section panels are internally wired in both directions, while all other panels are of 3/16" cable, doubled for drift loads and single for truing. The lift cables are double and the landing cables single. Large balanced ailerons are used top and bottom and are connected by streamline tubing instead of wires, thereby eliminating continual care and attention. Celluloid inspection doors are placed at all aileron control cable pulleys on the lower wings. Spruce struts of streamline section are used externally. All cable strut fittings are of the internal type, concentrating all loads on the neutral axis of the spar. As in the body and other parts, these fittings are chrome vanadium steel, heat treated and zinc plated, giving an enormous strength for their weight. On each end of the wings and under the outer struts are ash wing skids, which are sprung by rubber shock absorber cord covered by an all-metal streamline case. To the skid is hung a tube which telescopes into another tube mounted on a ball and socket joint to the rear spar. The front end of the skid is hinged to a fitting on the spar, while a diagonal tubing rakes the side action. The wings are linen covered and coated with clear varnish. The factor of safety is six throughout.

Empennage

This is of biplane type, having balanced elevators and three rudders, the outer two of which are also balanced. In front of the rudders are vertical fins. The construction is similar to the wings. To relieve the weight of the elevators upon the pilot controls these are equalized by rubber absorbers attached to a lever upon the rocker shaft in the rear end of the body. The elevators are also connected together by tubes like in the aileron system. The vertical fins are provided with adjustable screws on the top of the front ends, thus allowing the top tail plane to be set to any required angle.

A trimming plane is installed just ahead of the tail plane which can be adjusted in flight from the pilot cabin by a wheel before mentioned. This is worked by a screw and trunnion, so the setting is at all times positively locked in position. All vertical surfaces are enameled green, while the horizontal surfaces are finished similar to the wings.

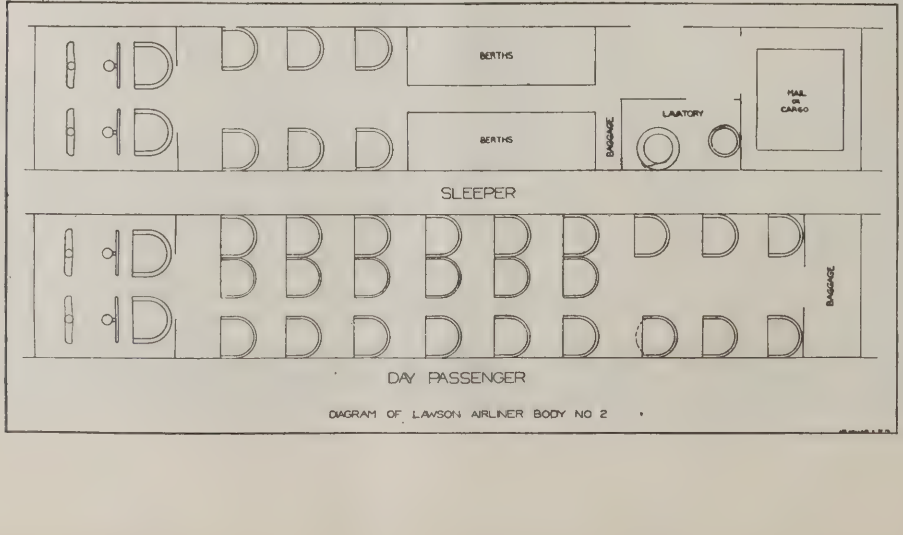


DIAGRAM OF LAWSON AIRLINER BODY NO 2

Landing Gear

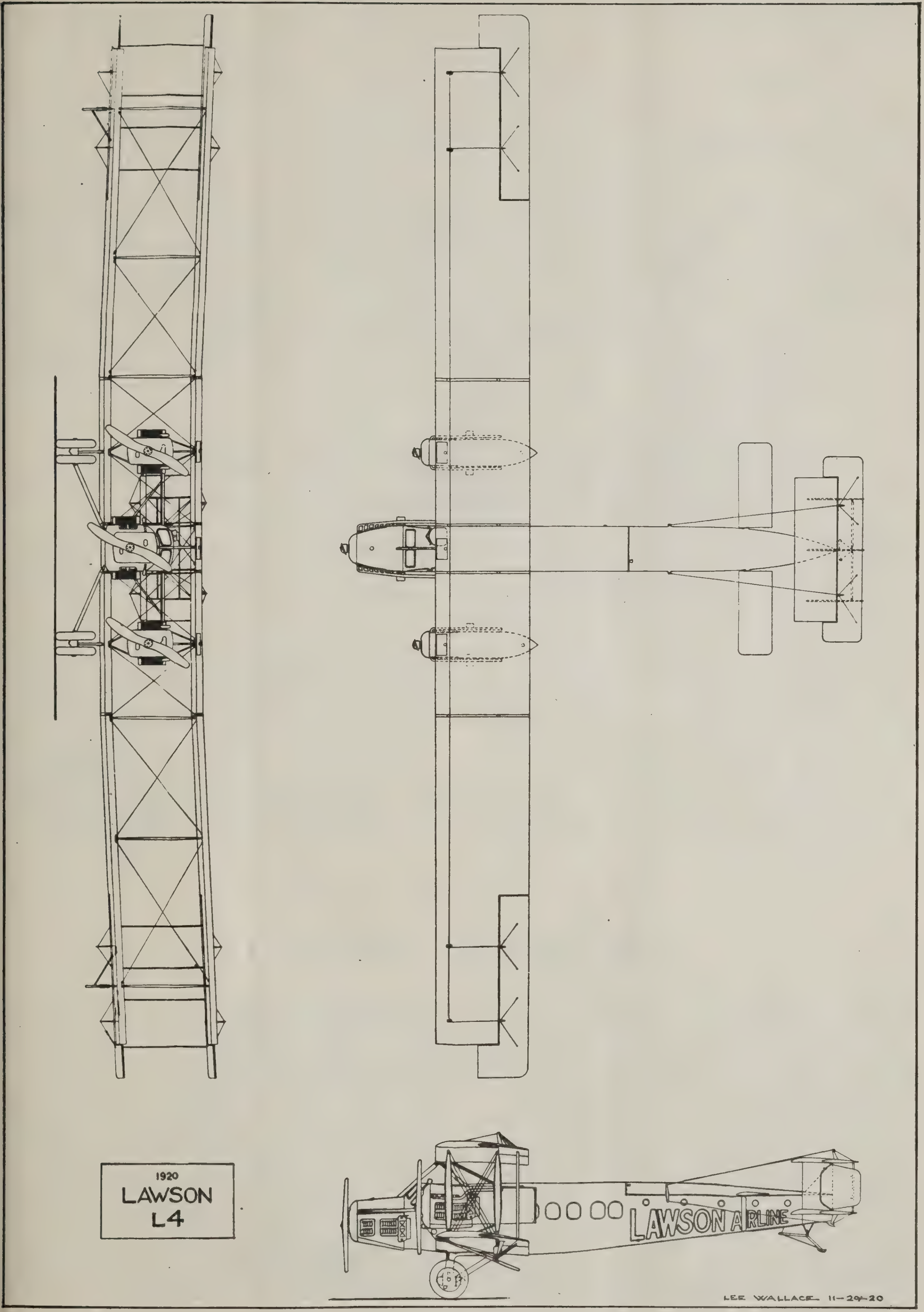
Four large Palmer Wheels of 1,250 mm. x 250 mm., or 49 x 10 ins., and streamline case, compose the main landing gear. These are placed upon short axles of high-grade steel tubing, which in turn are slid over cast steel elbows on the inner ends. This elbow is fixed to heavy compression tubes running up to the body and are pinned there. The Vee is triangular shape, made of laminated spruce, with the grain of the wood arranged as in the body bulkheads. On each side of the apex of the Vee are the rubber absorbers placed in line with the Vee. The nose and tail of the shock absorber brackets are cased with streamline fairings. The tail skid is rubber absorber sprung and is universally mounted to the body by four steel tubes. In case of failure of any part of this member the machine will fall upon a streamline bumper secured permanently to the sternpost.

Nacelles

On each side of the body and between the top and bottom wings are placed the nacelles. These are of spruce longerons, laminated bulkheads and struts, braced by 3/16" cables. The engines are directly behind laminated spruce nose-pieces, having vents for air circulation. The nacelles are completely covered with aluminum, excepting the nose-pieces, and all sides excepting the bottom are provided with large doors. The gas tanks in the rear end of the nacelles are protected by an aluminum fire plate. The bottom of each nacelle is formed to a well shape where oil and refuse may collect and drain out through pipes. The oil tanks are placed alongside of each engine and where they will receive a certain amount of cooling as well as allow a small amount of piping. Both engines are equipped with carburetor stacks which direct back firing out and away from the nacelles or tanks. Long exhaust pipes help to direct any flames away also, as well as to deaden the noises and carry any oil from the exhausts away from the machine completely. Inserted in the entering edge of the top wing are water header tanks. These are connected to the engine water outlet and radiator inlet pipes through large dier pipes, which also help to cool the water due to their exposure to the air. On either sides of the nacelles and behind the engines are the radiators, suspended on steel tubing and brackets. Although rather small they may be, they have been installed in this position after careful experimenting and tests which indicate this position the best for cooling purposes. All radiators are equipped with shutters on the rear side, these being operated by levers in the cabin. Each pair of radiators being connected together can be worked independently from any motor desired.

Center Engine

This, as before mentioned, is mounted on a detachable nose. The nose-piece is similar to the nacelle nose-piece as in the cooling. It is also equipped with carburetor stack and the same system of radiators. The fuel tank for this engine is under the pilot cabin. It will thus be seen that each motor has its separate gas system, thereby eliminating considerable trouble in case of a leak. All pipes and wiring are marked with the standard specications and identification colors to allow quick inspection, repair or assembly. The oil tank is alongside of the motor, thus again allowing the use of short piping.


1920
LAWSON
L4
LAWSON AIRLINE
LEE WALLACE 11-29-20

An aluminum fire plate attached directly to the bulkhead also separates the engine from the cabin.

Main Dimensions

Overall length	62 ft.
Overall height	18 ft.
	sq. ft.
Upper wing area, including ailerons	1,250
Lower wing area, including ailerons	1,175
Total aileron area	298
Wing section	U.S.A. 5
Chord	10.6
Gap	10.3
Upper stabilizer area	68
Lower stabilizer area	63
Total elevator area	116
Trimming plane area	68
Total fin area	36
Total area of rudders	48

Power Plant

Three Standard Libertys, 400 h.p. each, 1,700 r.p.m	1,200 h.p.
Three propellers, 10 ft. dia., 6'6" pitch	
Fuel consumption of each motor at 1,700 r.p.m., .5 lb. h.p. hr. (5.5 lb. gal.)	36 gal. hr.
Oil consumption of each motor at 1,700 r.p.m., .0373 lb. h.p. hr. (7 lb. gal.)	2.13 gal hr.
Fuel consumption of three motors	108 gal.
Oil consumption of three motors	6.39 gal.
Nacelle fuel tank capacity (2)	490 gal.
Center engine main fuel tank capacity	149 gal.
Center engine auxil. tanks (2)	94 gal.
Total fuel capacity	733 gal.
Nacelle oil tank capacity (2)	36 gal.
Center engine oil tank capacity	22.2 gal.
Total capacity of three overhead water tanks (3)	18 gal.

Weight Distribution

Structural weight, including wings, fuselage and nacelles complete, trimming plane, control surfaces and landing gear	7,434 lb.
Power plant, including water and tanks, gas tanks, piping and wiring, exhaust manifolds, nacelle tanks, propellers and radiators	4,560 lb.
Fuel and oil	4,589 lb.
Passengers, baggage and mail (as mail machine)	3,570 lb.
Passengers, baggage and cargo (as passenger machine)	4,360 lb.

Performance

	Mail.	*Pass.*
Total weight	21,462	22,820
Horsepower	1,200	1,200

Best ang. of glide	1 in 16.9 at 60 m.p.h.
Endurance at full power (ground level) at 108 gal. hr.	6.78 hrs.
Endurance at cruis. speed (6,000 ft.), 70 m.p.h. (1,400 r.p.m., 6.6 gal.)	11 hrs.
Maximum speed	112 m.p.h.
Landing speed	53 m.p.h.
Range full speed (112 m.p.h.)	825 mi.
Range econom. speed (70 m.p.h.)	800 mi.
Service ceiling	22,000 ft.

PERSONNEL OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

THE National Advisory Committee for Aeronautics, a digest of whose annual report was published last week, has twelve members, appointed by the President. The low provides that the personnel of the committee shall consist of two members from the War Department, from the office in charge of military aeronautics; two members from the Navy Department, from the office in charge of naval aeronautics; a representative each of the Smithsonian Institution, of the United States Weather Bureau, and of the United States Bureau of Standards; and not more than five additional persons acquainted with the needs of aeronautical science, either civil or military, or skilled in aeronautical engineering or its allied sciences. All members as such serve without compenastion. During the past year Mr. Orville Wright was appointed by the President to membership on the committee to succeed Dr. John R. Freeman.

The present organization of the committee is as follows: Charles D. Walcott, Sc. D., chairman; S. W. Stratton, Sc. D., secretary; Joseph S. Ames, Ph. D.; Maj. Thurman H. Bane, United States Army; Capt. T. T. Craven, United States Navy; William F. Durand, Ph. D.; John F. Hayford, C. E.; Charles F. Marvin, M. E.; Maj. Gen. Charles T. Menoher, United States Army; Michael I. Pupin, Ph. D.; Rear Admiral D. W. Taylor, United States Navy, and Orville Wright, B. S.

The Executive Committee.

For carrying out the work of the Advisory Committee the regulations provide for the election annually of an executive committee, to consist of seven members, and to include further any member of the Advisory Committee not otherwise a member of the executive committee, but resident in or near Washington and giving his time wholly or chiefly to the special work of the committee. The executive committee, as elected and organized on October 7, 1920, is as follows: Joseph S. Ames, Ph. D., chairman; S. W. Stratton, Sc. D., secretary; Maj. Thurman H. Bane, United States Army; Capt. T. T. Craven, United States Navy; John F. Hayford, C. E.; Charles F. Marvin, M. E.; Maj. Gen. Charles T. Menoher, United States Army; Rear Admiral D. W. Taylor, United States Navy, and Charles D. Walcott, Sc. D.

TRESPASS BY AIRCRAFT

DISCUSSION over the Air Navigation bill before a House of Commons committee recently brought up the question: What constitutes trespass or nuisance committed by aircraft flying over private property? This bill gives effect to a convention for the regulation of international air navigation and air navigation within the United Kingdom. The section of the bill which aroused this Parliamentary debate reads: "No action shall lie in respect of trespass or in respect of nuisance by reason only of the flight of aircraft over any property at a reasonable height above the ground."

Just what a reasonable height is was not made clear in the debate. It was stated by Lieutenant-Colonel Moore Brabazon, who spoke for the Government on behalf of the measure, that the present regulations about low flying and "stunting" over houses were very strict. The penalty for a civil aviation pilot for such an offence was the withdrawal of his license, while any member of the Royal Air Force so offending would be "booted out" of the service. The speaker offered the opinion that flying over London under 7,000 feet was unsafe, whereupon one of the members interjected: "If 7,000 feet is the proper height for London, I have seen the law broken hundreds of times." Eventually an amendment was agreed to, the effect of which was that no action should lie in respect of trespass or nuisance from the passage of aircraft, provided that they flew at a reasonable height above the ground. subject to weather and other conditions. At this distance from St. Stephens we should say this decision arrived at the point from which the debate started.

This question of aeroplane trespass has a local application from quite another angle. This is in the amount of time taken from office work in establishments facing on the North River by the watching of passing of aeroplanes, seaplanes, and blimps. If this were figured out by some efficiency engineer it would amount to many working hours in the course of a year. This raises the question: Who is responsible for this trespass in the form of lost office work? The Government owns most of these machines, although there are a few privately owned flying craft that use the air over the river for their pathway. The only way to prevent trespass of this kind over New York City is to have all flying conducted at about a height of 20,000 feet. Then the trespass would be obviated by the application of the maxim which insists that out of sight is out of mind—*Editorial in N. Y. Herald.*

INSTRUMENT FOR MEASURING ENGINE CLEARANCE VOLUMES

By S. W. SPARROW, Automotive Power Plants Section, Bureau of Standards

THE following Technical Note on an Instrument for Measuring Engine Clearance Volumes was designed and constructed under the direction of the Automotive Power Plants Section of the Bureau of Standards, and was submitted for publication through the Subcommittee on Power Plants for Aircraft of the National Advisory Committee for Aeronautics.

A few years ago, when the gasoline engine with vertical cylinders was the well-nigh universal type, a description of apparatus to measure clearance volume would have aroused little interest. In the highest part of such cylinders there was usually located either a valve or a spark plug through the opening for which liquid could be poured. The volume of liquid required to fill completely the combustion space with the piston at upper dead center served as the clearance measurement. To be sure, it was a rather messy procedure requiring considerable time to remove the liquid when check readings were desired, but otherwise was fairly satisfactory. With the advent of the V type engine, the problem ceased to be simple. Frequently it was almost impossible to make this measurement with the engine mounted for test, as all openings were then below the highest point in the cylinder.

In the summer of 1919, Major Norman of the English Royal Aircraft Establishment at Farnborough suggested making this measurement by a process which consisted essentially of simultaneously changing both a known and an unknown volume of gas by a known amount and then calculating the magnitude of the unknown from the resulting difference in pressure between the two. To Dr. Dickinson, who was in Europe studying aviation development, the idea made instant appeal and on his return to the Bureau of Standards he started the construction of an instrument based on this principle. In the first instrument, Fig. 1, no attempt was made at refinement in constructional details as it was believed that, once the instrument was proved practical, its use would suggest such changes as would make for greater accuracy and convenience of operation. In the development of the present design, Fig. 2, Mr. C. W. Elliot has incorporated many such changes but in all major features the instrument is the same as the original built by Mr. A. R. Long, to whom much of the credit for its success is due.

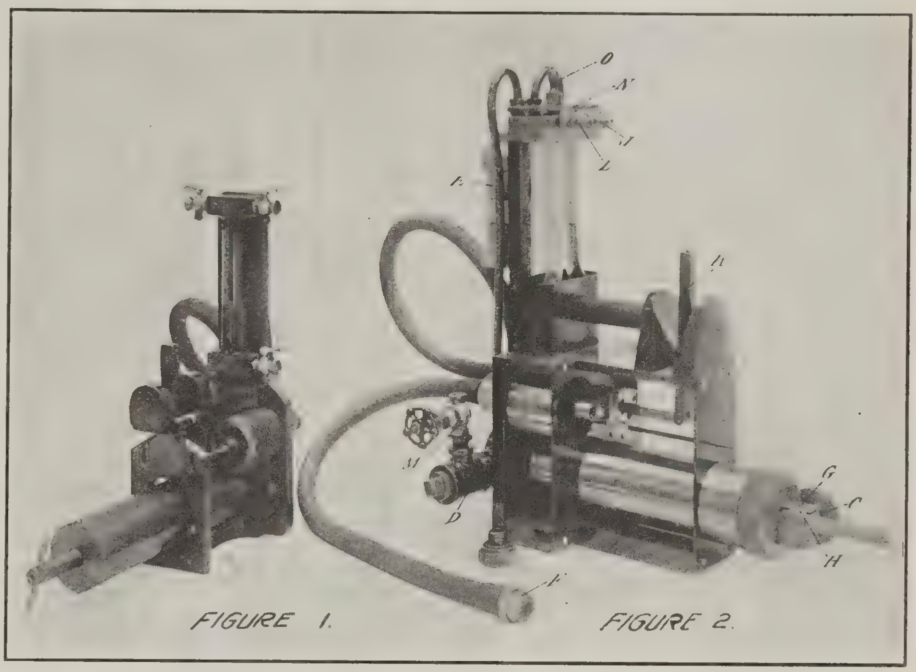


FIGURE 1. FIGURE 2.

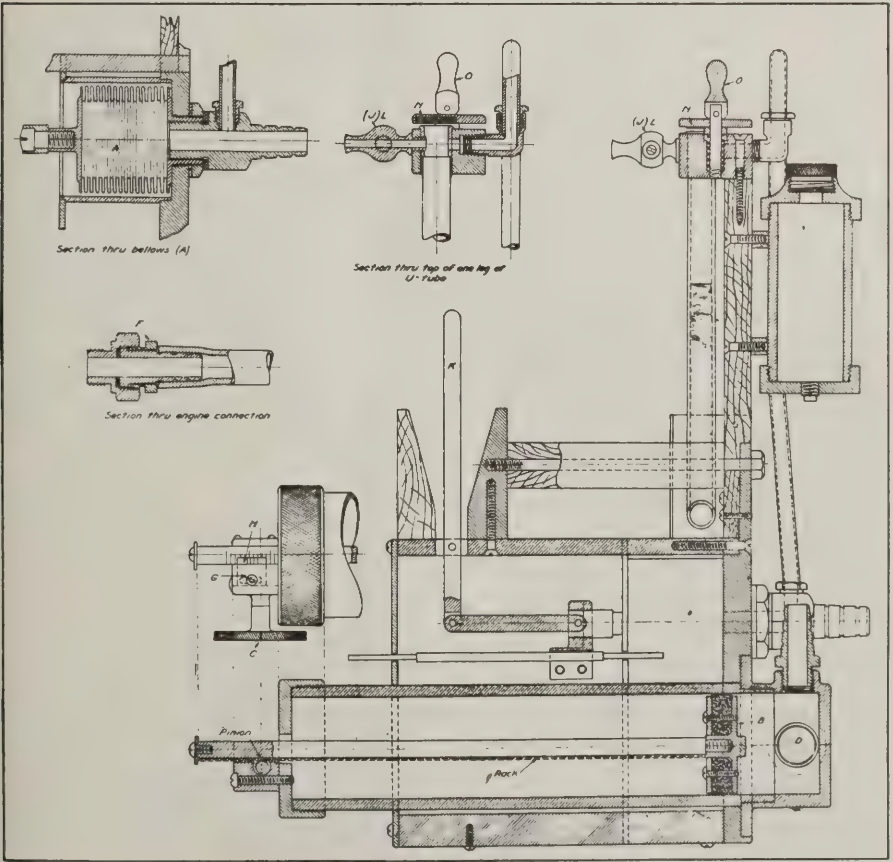

Section thru bellows (A)
A
(V)L
N
O
Section thru top of one leg of U-tube
F
Section thru engine connection
(V)L
N
O
K
M
G
C
Pinion
Rack
B
D

Figure 3

The principle of the apparatus is shown in Fig. 4. If the volumes A and B are each decreased the same amount by the movement of the pistons, there will be a pressure increase in each cylinder, the greater increase occurring in the smaller volume. The pressure difference will be indicated by the difference in liquid level in the U tube connecting the two cylinders. In practice, Volume a, the clearance volume, is always unknown, while in the other, Volume b, can be altered by moving piston c, Fig. 5, in or out of the measuring cylinder and its magnitude read from the scale on the piston stem. This calibrated volume is changed until the movement of the two companion pistons produces the same pressure increase in both cylinders as indicated by the liquid in the U tube remaining level. Both volumes are then equal. The above statements hold true only if both cylinders are air-tight or if both leak at the same rate. Since the engine cylinder is never strictly tight, an adjustable opening is provided to permit an equal rate of leakage from the comparison cylinder. For clearness, the simultaneous volume changes are described as taking place in the clearance and measuring volumes, whereas actually there are auxiliary volumes d_1 and d_2, connected with these in which the actual change is made, so that it is (clearance volume + auxiliary volume d_1) and (measuring volume + auxiliary volume d_2) that are changed. The addition of these auxiliary volumes simplifies the apparatus for making the volume changes and inasmuch as both are equal, does not alter the relations described above.

The actual instrument is shown in diagram in Fig. 6, in section in Fig. 3, and in the photograph, Fig. 2. For producing the changes in volumes the pistons, shown in the schematic drawing, have been replaced by the cylindrical copper bellows, A. Changes in the comparison volume are produced by turning hand wheel C, the motion being transmitted to the piston B through a gear and rack. A vernier and graduated scale on the piston stem permit the direct reading of volumes up to 48 cubic inches in steps of one-tenth of a cubic inch. Should it ever be necessary to measure larger volumes, an auxiliary cylinder can be connected to Tee, D, now closed by a pipe plug. The measurement would then be made as before except that to the reading on the piston stem should be added the volume of the auxiliary cylinder. Tank E is a check volume of 7 cubic inches, used only for calibrating purposes. When the tubing is renewed, fitting F is screwed into the tank, screw G loosened, and vernier H adjusted to read exactly 7.

Measuring clearance volumes consists of three distinct steps:

1. Measuring the rate of leakage from the engine cylinder.
2. Making the rate of leakage from the comparison volume equal to that from the engine cylinder.
3. Equalizing the comparison volume with the clearance volume.

In measuring the rate of leakage from the engine cylinder, after having latched cover plate N, needle valve J is opened, leaving the right side of the U tube open to the atmosphere. Lever K is then pulled back until a considerable pressure difference is produced. The leakage rate is estimated by noting the approximate time required for the pressure to decrease a definite amount. Valve L is next opened and J closed, one side of the U tube now being open to the atmosphere and the other connected to the comparison volume. Valve M is then adjusted until the leakage rate is approximately the same as that from the engine cylinder.

In equalizing the volumes, valves J and L are both closed, the left leg of the U tube then being connected to the engine cylinder and the right leg to the measuring cylinder. When changing the volumes by means of lever K, it is most convenient to watch but one leg of the tube. If the left leg be the one chosen and the initial movement of the liquid is downward, it indicates the pressure in the engine cylinder to be the greater and its volume to be the smaller. After relieving the pressure on both sides by raising cover plate N, the volume in the measuring cylinder should be decreased. The cover plate is again lowered and secured tightly with latch O and the process repeated. The correct volume is that with which there is no change in liquid level noted at the first application of the pressure.

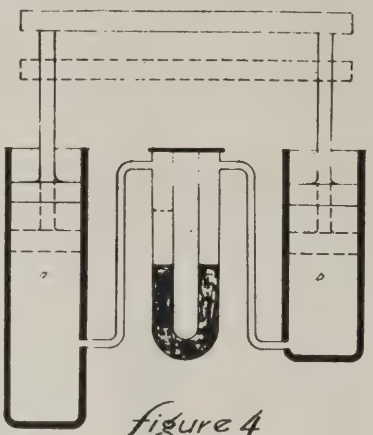


figure 4.

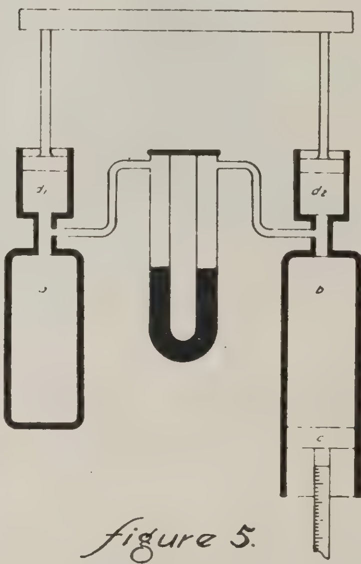


figure 5.

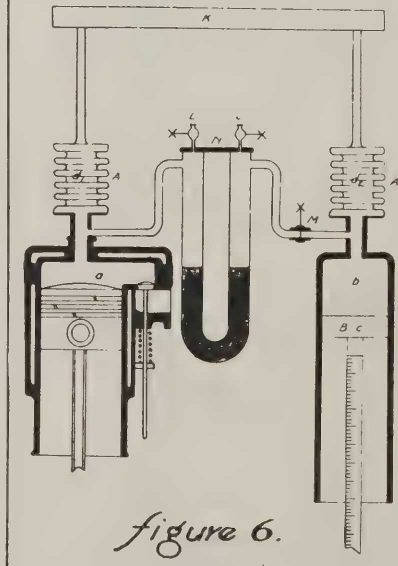


figure 6.

It will frequently be found that with the volumes well equalized, after the pressure has been maintained for a second or two, the deflection of the liquid in the U tube will increase, showing that the leakage rates have not been perfectly balanced. A few trials will readily convince the operator that it is the initial movement that should be considered in adjusting the comparison volume and that extreme care in balancing leakage is unnecessary. The explanation will be evident from a consideration of the effect of a difference as large as 10% in the leakage rate from the two volumes. For this purpose, let the rate be assumed as .03 cubic inches per second, a rather high value for the small pressure increase produced with this instrument. With the above assumption, a measurement taken at the end of one second will be in error by the difference in the amounts that have leaked from the two volumes, namely, $.03 - .9\ (.03) = .003$ cubic inches. The sensitivity of the instrument, however, is about 1%, a difference between the comparison volume and the measured volume of this amount being required to produce a readable deflection on the manometer. The .003 cubic inch error will therefore be too small to be noticed in measuring volumes of the magnitude of engine clearance spaces. The initial manometer deflection observed can therefore be attributed entirely to the difference in the magnitude of the two volumes.

In using this apparatus, care must be taken to prevent temperature changes in either volume as a change of 3 degrees C will change the deflection a noticeable amount and hence vitiate the result. Obviously, such measurements should never be attempted immediately after operating the engine, before it has cooled to normal temperature.

To attempt precise measurements of a clearance volume without first carefully setting the piston at dead center would be utter folly. Markings on flywheel or propeller hub make this a matter of comparative ease in the majority of cases. In the absence of such markings, the clearance measuring apparatus may be connected as was done for measuring leakage with valve J open and L closed. This merely enables the U tube on the instrument to be used to measure the difference between the pressure in the cylinder and the atmosphere. Moving the piston toward upper dead center produces pressure; moving it away, suction. In the Liberty "12" one degree motion of the crank from dead center can be detected with this instrument.

In every branch of internal combustion engineering there is an insistent demand for greater economy in operation and there is at present a decided trend toward increased compression ratios as a means of meeting this demand. With the higher compression ratio the margin between normal operation and preignition is reduced and the manufacturer must exercise greater care in maintaining clearance volumes within close limits. To accomplish this, suitable measuring apparatus will be required and it is in accordance with a policy of anticipating the needs of the industry that the instrument described above has been prepared.

THE SOARING FLIGHT OF BIRDS[*]

By LEON BOLLEE

I—The Problem Stated

ALL the theories on the soaring flight of birds that I have seen, and perhaps I have not seen them all—apart from those leading to perpetual motion, which cannot be entertained—agree in seeking for the cause of the mechanical energy employed in horizontal soaring flight in the wind itself. Every investigator worthy of respect insists on the point that *a priori* the wind cannot be a source of energy unless it has motion relatively to the bird.

It is clear that a regular horizontal wind cannot provide a source of energy for a bird which has no attachment with the earth, any more than a windmill fixed on the car of a free balloon could furnish the slightest motive power even in a high, regular wind, although this power would be appreciable if the balloon were a captive one.

In consequence, serious investigators, in attempting to explain soaring flight, have considered winds possessing one of the four following characteristics

(1) Rectilinear, horizontal, irregular winds.

(2) Horizontal winds rapidly alternating in direction.

(3) Horizontal winds in thin, superimposed layers moving at different speeds.

(4) Ascending winds.

These four types of winds have formed the basis for four different theories, each strongly supported by its authors and not less warmly attacked by the advocates of the others.

According to the first theory, which is endorsed by practically all the authors of recent treatises on soaring flight and was first put forward by Mouilland in 1881 and later more scientifically explained by Bazin in 1888, Langley in 1893 and R. Soreau in 1895, the horizontal wind constantly varies in speed; it blows in gusts with regular and swiftly succeeding periods; it is these gusts which, encountering the inertia of the bird, become, by means of an appropriate altitude of the bird's wings, a source of energy sufficient to lift the bird, which, during the ensuing lull, takes advantage of his gain in height to glide down in the ordinary way. We may term this the "switchback" theory.

According to the second theory, very ably expounded by Alexandre Sée in 1908, the wind is still horizontal, but alters rapidly in direction, and these side-gusts strike the bird alternately on one side and the other, the bird's inertia being sufficient to produce a realtive wind which furnishes, by a suitable altitude of its wings, the energy required for sustentation and propulsion.

The opponents of this theory maintain that, even if it explains the ziz-zag flight and the balancing of seagulls, it does not explain motionless flight in space, nor soaring flight in regular circles, nor rectilinear flight without oscillations, nor the flight of gulls above the waves with or without a wind, nor, finally, the soaring flight of birds in all directions over level plains without any appreciable wind.

According to the third theory, the wind is regular at any given height, but has neither the same direction nor the same velocity at a slightly greater or lesser altitude, so that the bird by passing often enough from one layer to another can produce, by means of its inertia, which opposes any immediate change in velocity or direction, the relative wind furnishing the energy required for its lift and forward motion.

The opponents of this theory throw doubt upon the existence in thin superimposed layers of winds differing in velocity and direction from one another, and further maintain that soaring birds do not follow an undulating flight-path, but can and do preserve a constant height.

With regard to the fourth theory, that of ascending currents, this had already been pointed out long ago by Leonardo da Vinci, later by Pénaud, and again, in 1908, by Marcel Desprer in a communication to the Academy of Sciences, and everyone subscribes to it. Their action is easily explained. A bird when flying head-on in an ascending current varies the incidence and spread of its wings so that the total vertical lift produced by the relative wind is equal and opposed to the bird's weight. This explains the motionless hovering of gulls above jetties, for instance, in stormy weather.

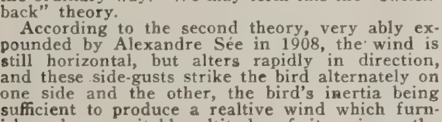


Figure 1

But the advocates of the three preceding theories object that this cannot constitute the explanation of soaring flight in every case as the causes producing a vertical deflection in the wind and provoking an up-current are too few and far between to explain every type of soaring flight. It is this consideration which has led the majority of investigators to the conclusion that the general explanation of soaring flight must be sought in one of the first three theories.

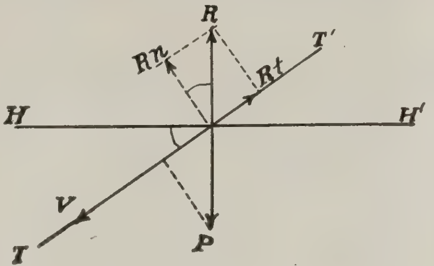


Figure 2

Here I would add the following remark. As soon as the soaring bird is no longer in proximity to the earth's surface with its little irregularities it must necessarily have recourse to ascending currents, since there are no others at these altitudes.

I will go further and state that I believe that the inertia of the bird, which is the basis of the first three theories, plays no part in soaring flight save at two periods: the first at the start of a flight, when the bird, starting head to wind, creates for a few seconds a relative wind which he can use, and the second when the bird rises above the zone of trees and houses which slow down the wind and suddenly encounters the full force of the wind and so again sets up a relative wind.

In order to make use of the eddies which exist close to the ground, birds would have to fly in such irregular jerks that they would avoid rather than seek them.

II—Gliding Flight

Before examining the type of wind which renders soaring possible, we may begin by likening the motion of a bird to that of a rigid, gliding machine moving, first, in calm air and, secondly, in a regular wind of given velocity and direction.

It may be noted that a bird can shift its centre of gravity relatively to its wings. Further, it can alter at will the area and incidence of its wings and tail, and the position of its head and legs.

Within certain limits, every altitude of the bird has a corresponding rectilinear gliding path whose downward slope is fixed and which is followed at a given speed. Among all possible altitudes there is one for which the downward slope is least. This we may term the "normal" altitude. This position will give the bird its least downward velocity and for an equal loss in height to travel the greatest distance in the horizontal plane. This may be seen in Fig. 1.

If P is the weight of the bird and R the resultant pressure of the relative wind on all the parts of its body, and the bird is to follow the flight-path TT^1 at a new form velocity V, the forces P and R must be equal and opposite. In other words, R must be vertical and equal to the Weight P. If P is resolved into its components Rt and Rn, it will be seen that the slope of the flight path is equal to Rt/Rn, that is, to the ratio of the useful and detrimental components of the total pressure or of the lift and the drag. The minimum for Rt/Rn is no more than 1/10 even for the finest soaring birds.

Now for the speed and direction of the wind required to enable the bird to maintain horizontal flight. Let HH^1 represent the horizontal plane, O the position of the bird and OV its relative velocity in magnitude and direction. For the bird to remain horizontal, the wind must have a velocity represented in magnitude and direction by the arrow Vv. Fig. 3 shows that the smallest wind velocity to enable soaring is that of a vertical wind. If OV represents the smallest downward speed, for which the corresponding flight-path is 1 in 10, the wind velocity v should be about one-tenth of V. If $V=10$ ft. per second (which is about true in actual practice, v need only be 1 ft. per second.

There is another case in which the wind is directly equal and opposite to OV, that is, equal to VO. In this case the bird remains poised motionless relatively to the earth. For this to happen, the wind has to be fairly strong: 10 ft. per second in the above example. But, generally speaking, v is not equivalent to VO, and the bird moves in the horizontal plane HH^1 with a speed VO. If therefore it wishes to hover over any given spot on the earth's surface it will have to describe circles in the air. Again, if it wishes to move from one place to another, it modifies the direction of its own speed Ov, so that the direction of the resultant speed OV passes through the point selected by it.

If the wind velocity is greater than V and is in the right direction, the bird will move backwards relatively to the earth.

If the ascending current has a greater speed than that required to sustain the bird, the latter can do one of two things. Either it can elect to rise by virtue of the excess upward speed of the wind, or it can maintain a constant height by altering its altitude and increasing its downward velocity.

By the aid of these elementary considerations it is possible to explain every manoeuvre of soaring birds and to lay down the conditions in which they occur.

III—The Real Nature of the Wind

Before coming to a decision on the respective mreits of the three theories set forth above, each of which takes into account the ineritia of the bird and the irregularity of the wind, I determined to see for myself whether the wind, as claimed by the protagonists of each theory, in order to explain their thesis, does in fact exist in Nature.

After all, this is the only satisfactory starting-point; for if a type of wind does not exist, any theory based on the existence of this type of wind, however learned and ingenious it may be, falls to the ground. The birds can only use winds that actually exist.

It was with considerable surprise that I found to what an extent the means of observation employed by the propounders of the three theories in question were calculated to give their authors an altogether false idea regarding the true nature of the wind. These means were all based on the observation of smoke from factory chimneys, of horizontal or vertical wind-vanes, or of anemometers or other similar instruments, but in every case near the earth's surface. It is obvious that the flow of a fluid observed in proximity to the walls of a pipe is influenced to a large extent by the roughness of these walls; irregularities cause wave motion and eddies which, when recorded by instruments, might give ground for the conclusion that the entire flow was irregular, whereas it was only that portion in close proximity to the walls.

I therefore made my observations in the free atmosphere during numerous balloon ascents in 1908 and 1909. During these ascents I made careful observations of the motion of the wind in the zone used by soaring birds, but above that directly affected by slight irregularities on the earth's surface, such as houses, trees, depressions in the ground, etc. I had an excellent opportunity for so doing, for my balloon, christened the *Aero Club of the Sarthe*, of 42,000 cubic feet capacity, weighed, including gas, about a ton and a half, and therefore possessed sufficient inertia not to respond instantaneously to the vagaries of the wind.

I was, therefore, in an excellent position for observing, by means of horizontal silk threads and long thin strips of paper hanging below the car and far enough down not to be affected by any eddics caused by the balloon itself, the motion of the air relatively to the mean which was represented by the balloon, thanks to its mass. Further, by releasing pieces of tissue paper, I could observe the motion of the wind at lower levels and see whether it differed appreciably in velocity or direction for slight variations in height.

As the result of many ascents and observations, I have come t the cnclusin that, if the wind is observed at some distance from the earth where it is no longer affected by obstacles on the surface it will be found that:

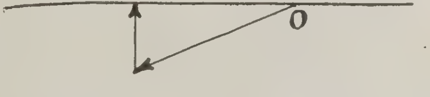


Figure 3

(1) The wind at any given level has no sudden variations in speed from the mean and, above all, no periodic fluctuations. There is no relative wind that could be used for soaring.

(2) The wind often has variations in speed and direction, but these variations can only be perceived at widely separated levels. *In practice these variations cannot be used for soaring purposes*

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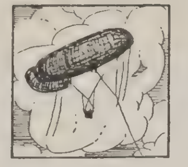
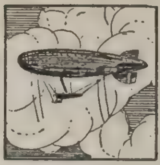
[*] This treatise is based on the rough notes of the famous engineer, collected after his death and edited by his friend Professor d'Ocagne. It is reproduced by courtesy of *Aeronautics* and our contemporary *l'Aerophile*, in whose pages the original was published. Bollée was an intimate friend of the brothers Wright, and it was at his direct invitation that Wilbur Wright came to France in June, 1908, to make his epoch-making flights. Bollée's interest in the problem of soaring flight dates from this time, and his conclusions were largely based on his personal observations made during balloon ascents.



FOREIGN TECHNICAL DIGEST



New Fokker Air Limousine

The machine is a parasol monoplane of 16.1 m. span.

It is free from any external wiring, the wing having the usual Fokker 4-point attachment to the fuselage. The engine fitted is 185 h.p. B.M.W. The weight empty is 1,200 kilograms, with a useful load of 700 kilograms (fuel, pilot and five passengers). The speed is given at 150 km./hr.

The underlying principle of the design is low cost and small fuel consumption; the former is ensured by the simple construction, the latter by the efficiency of the engine fitted. (*Luftfahrt,* July, 1920. 1 col., 2 photographs.)

Swiss Military Aeroplane

The first Swiss military aeroplane, S.W.S.C1, was completed in March, 1919.

It is a two-seater biplane. The body is of veneer construction, 0.950 m. broad by 1.225 m. deep, and the vertical fin and tailplanes are integral with the body. The planes are 1.45 m. apart. The lower planes are horizontal; but the upper planes have 2° dihedral, are staggered forwad 0.80 m. and the wing tips swept back 0.30 m. The total areas of rudder, elevators, and ailerons are respectively 0.69 sq. m., 1.80 sq. m., and 2.0 sq. m. The machine is fitted with an Argus-Seebach motor (185 h.p.). The main tank holds 150 liters and the emergency tank 30 liters. Fully loaded, the aeroplane can fly for three hours. The speed is 150 km./hour, and the machine climbs to 4,000 m. in 21 minutes, to 7,000 m. in 44 minutes; the ceiling is about 7,500 m. The armament consists of two machine guns. Details of construction and fittings are given. The following are the main particulars:

Weight empty (incl. water)	760 kgs.
Weight loaded (incl. 2 machine guns)	1,160 kgs.
Length	7.850 m.
Span of upper wing	11.540 m.
Span of lower wing	10.960 m.
Total height	2.930 m.
Wing area	30.8 sq. m.

(*La Suisse Aerienne,* Aug. 10, 1920. 10 cols., 9 figs.)

Airship Attacks

This article is an extract from Admiral Scheer's book, entitled "The German High Sea Fleet in the World War."

At the outbreak of the war the German Navy possessed three Zeppelins, each of 15,000 cubic meters capacity. During the war this number was increased to sixty-seven, seventeen of which were lost due to enemy action, thirty-four were accidentally destroyed, and six were captured by the enemy. This left ten airships available at the armistice.

The ships differed in size, which latter continually increased as the war went on. Type L-50 had a volume of 55,000 cubic meters, five engines of 260 h.p., a speed of 110 km./hr., and a useful load of 38 tons. In type L-70 the volume had increased to 62,000 cubic meters, seven engines were now fitted, and the useful load increased to 43 tons at 130 km./hr. They were armed with machine guns and later types also carried a 2-cm. gun. The crew numbered twenty to twenty-five all told.

The rapid development of the aeroplane soon rendered the airship useless on the Western Front. It did, however, invaluable service for the German fleet, and was also used in many air raids on England. Details of some of these raids are given. The last one took place August 5, 1918, when L-70 was shot down. (Admiral Scheer, *Luftfahrt,* June, 1920. 4½ cols.)

Aircraft in Thunderstorms

The author discusses the possibility of aeroplanes in flight being struck by lightning during a storm, basing his arguments on test flights under such circumstances numbering 70, and on general principles.

He shows that no danger is to be expected in the first place if the machine is not in the direct line of a discharge, and in the second place even if it is, it is not likely from the nature and distribution of the conducting metal portion that danger due to fire will arise. Out of thirty cases where the machine was struck directly the writer maintains there were no evil effects, while in all known cases in Germany where a machine fell during a storm there was no evidence of scorching of parts or melting of metal. (Major D. Carganico, *Illustrierte Flug-Welt,* Aug. 4, 1920. 4 cols., 1 fig.)

The Problem of the Helicopter

This paper was read before the Royal Aeronautical Society in London by Louis Damblanc, the noted French aeronautic engineer, who has made extensive experiments with the direct lift machine.

The paper deals with the lifting force and lifting screws, sustentative value, construction of the lifting airscrew, stability, equations of sustentation and practical co-efficients, weight of the helicopter, descent of a helicopter with stopped motor, case of the declutched air screw and stoppage of the engine during vertical ascent. (*Flight,* Nov. 25—6 pp., 7 fig.)

Spins

A paper read by H. Glauert before the Cambridge University Aeronautical Society to show that the spin is not a form of instability, but one of the possible steady motions of an aeroplane.

The characteristics of the spin are gone into in detail and experience with different types of British planes are noted as illustrations.

The writer covers in detail the starting and recovering from spins. (*Aeronautics,* Nov. 25, 1920. 3 col.)

The Gastambide and Levasseur Wing

This article reviews in detail the test flights made with the Gastambide-Levasseur plane constructed by M. Latham and a brief description of which was presented in AERIAL AGE recently. (*L'Aerophile,* Nov. 1-15,—5 pp., 3 illus., 1 diagram.)

Visibility at Various Altitudes

This article by Georges Brunel discusses the varying radii of visibility from different heights ranging from 1 metre to 10,000 metres. (*L'Aerophile,* Nov. 1-15.)

Albatros Type L-57

This paper describes one of the latest types of Albatros passenger carrying monoplanes. There are three models equipped, respectively, with 170 H.P. Mercedes, 185 H.P. B.M.W., 200 H.P. Benz. The machine accommodates six passengers in an entirely enclosed cabin luxuriously upholstered, with the windows so arranged that the visibility is good. (*Illustrierte Flug-Welt,* 5 col., 1 illus., 1 diagram. Nov. 24.)

Free Ballooning

This article by Von Petschow relates the recent interest in free ballooning in Germany and gives details of the distances of the flights made, together with photographs of the equipment used, and a series of photographs taken from the balloons. (*Illustrierte Flug-Welt,* Nov. 24.)

The Zodiac Blimp

The Zodiac sport-airship, or blimp, is described in this article and data is given concerning its construction and performance. It is equipped with a 60 H.P. Gnome or LeRhone motor and has accommodation for four passengers and pilot. (*Illustrierte Flug Welt,* Nov. 24.)

Electric Guides for Night Landing

The article describes an interesting solution to the difficulty of landing aeroplanes at night by providing the landing field with a series of submerged light towers, one placed at each major and divisional point on the compass and controlled at a central switch board so that the lights may be switched on to indicate the wind direction and the most suitable way of landing. (*Illustrierte Flug-Welt,* Nov. 24. 2 col. 5 illus.)

Italian Aviation Progress

In this report Col. Cristoforo Ferrari, director of technical aviation, gives a detailed statement of the progress in aeronautics in Italy during the past year and outlines the contemplated progress for 1921.

It is stated that a suggestion that a national conference be held in Italy during the year 1921 has met with general approval and it will probably take place some time in June. (*L'Aeronautica,* Sept.-Oct., 1920. 5 pp.)

The Leitner-Watts Metal Airscrew

The result of this construction is that using quite a small number of standardized blade forms, in conjunction with bosses which will mount either two, three, or four blades, and finally by adjusting the angle of the blades in the boss, an enormous variety of different types of aeroplane can be fitted with suitable airscrews, all of them assembled from a relatively small number of different components.

The blade is formed of two mild steel pressings, edge welded together, reinforced by a number—in this case two—of internal liners. The total thickness of metal is gradually reduced from boss to tip in accord with the stresses set up in the blade by rotation. These reinforcing liners are edge welded, and they are also either riveted or spot welded to the outer sheath along their edges only, and thus, although they are in contact with the outer plating, they are not rigidly attached to it except at the edges of the liners.

The boss end of each blade is formed of circular section, and is reinforced within and without by further liners, which are machined from forgings.

The bosses, two, three and four blades, are machined from steel forgings, split on the plane of rotation of the airscrew, and clamp the blades in position, when they are held positively by the shoulder on the end of the blade itself. (*Aeroplane,* Dec. 1, 4 cols., 2 figs.)

NAVAL and MILITARY AERONAUTICS

Moseley's Unofficial Record 200 Miles Per Hour

Captain C. C. Moseley, of the United States Army Air Service, established an unofficial world's record for straightaway speed by making 200 miles an hour on three different occasions during his flight around the 130-mile triangular course over Long Island on Thanksgiving Day.

This fact is brought out in his report to Major General Charles T. Menoher, director of the Air Service, made public yesterday. Captain Moseley's average speed for the 135 miles was 178.6 miles an hour, which is the official world's record for closed circuit racing.

The report vividly portrays the sensations experienced while flying at more than three miles a minute. Regarding his speed, Captain Moseley says:

"During the first three laps I managed to get the motor to run wide open for about thirty seconds, each time on the second leg of the triangle, and the air speed indicator immediately ran up over 200 miles an hour, but the violent missing would commence again and I would have to throttle down."

Telling of his sensations, he says: "With the head placed back against the head rest, the blast of air produces a sort of pounding effect on the head which is very uncomfortable, and the combined noises of the wires and the rush of the air is almost deafening."

It was the missing of the engine that prevented the biplane from being flown around the course at full speed, and so prevented the establishment of a clean-cut world's record, he says.

"My own personal opinion as to the cause of this 'miss' is," he says, "in the location of the carburetor. The carburetor is placed on the bottom of the motor with the air intake opening downward. I believe that at high speeds the air rushing by the opening of the intake at such terrific speed makes a vacuum, which causes an over rich mixture. To bear out this theory bursts of black smoke were thrown out when the motor missed.

"I flew the entire race at an altitude of 400 feet, and, although my air speed indicator registered around 180 miles an hour almost all of the time, I could not quite realize that I was going that fast except from the terrific wind blast."

Naval Officers at Army Field

A number of officers of the Fleet Air Detachment left North Island recently for advanced instruction and work at the U. S. Army Field at Riverside, Cal. Those included in the list are Lieutenant McKellar, Lieutenant Chourre, Lieutenant Weid, Ensign Callaway, Ensign Brown and Ensign Groh. The course given is one of the best given at any aviation field in America, under the direct supervision of the best instructors, including among which are those who have made a great record in the World War, having brought down many planes on the advanced front lines. The course will cover the general instructions of aviation and cross-country flying and will be completed with work in gunnery. The types of planes that will be used will be the JN-H, the Thomas Morse Scouts and the SE-5. After the completion of the course of instruction at March Field, the aviators will return to North Island in connection with their duty with the Fleet Air work.

Forest Fire Patrol Activities from March Field

A consolidated report of foreign fire patrol activities carried on from this base from May 19th to October 31st gives some interesting statistics:

Total number of flights	314
Total flying time	1,143 hrs. 38 min.
Total gallons gasoline consumed	19,990
Total gallons of oil consumed	1,222¼
Area of square miles covered	131,479,493
Total miles flown	108,920
Total number of fires discovered	131
Total number of planes flown (DH-4B's)	6
Total number of minor accidents	1
Total number of major accidents	None

This patrol was carried on under the direction of Captain Ernest Clark, officer in charge of flying at this field. Pilots were graduate cadets from this school. C. R. Benton, forester, was stationed at the field during he patrol season, relaying information about fires from the radio station to the various rangers in the mountain reserves.

Radio News Daily at Post Field

The Personnel of Post Field is furnished daily with Radio Press Dispatch from the Air Service Communications School here. The items are posted in a daily bulletin and contain all weather reports, Naval Press Reports from Arlington station, Washington, D. C., and New York City concerning all items of interest which the Radio Station can pick up from the air.

New Course for Flight Surgeons at Mitchell Field

A new course for flight surgeons commenced at the Medical Research Laboratory on November 16th and will continue until January 25, 1921. This course consists of lectures, demonstrations and practical work at the laboratory and clinics in New York City. All subjects pertaining to aviation medicine and which will be of advantage to the flight surgeon in his work are covered in the course. In addition each officer is taught to perform a "609" examination and to conduct a rebreathing examination. The following student officers are in the class:

Major R. F. Longacre, M.C., from Kelly Field; Major A. M. Brailsford, M.C., from McCook Field; Captain G. S. Willey, M.C., of Mitchel Field; Captain J. F. Hickam, M.C., from Eagle Pass, Texas; Captain P. D. Moulton, M.C., from Camp Upton, Long Island; First Lieutenant D. W. Bedinger, M.C., from March Field, California; and First Lieutenant G. P. Rawls, M.C., from the Aviation Repair Depot at Indianapolis, Indiana.

Dog Makes a Parachute Jump

Bing, the dog mascot of the Air Service Mechanics' School at Kelly Field, San Antonio, Texas, made a successful pull-off from the upper wing of a De Haviland 4-B plane. A special harness was fitted to him and an eighteen-foot seat pack was used. Bing made the journey aloft, to the altitude of 1,000 feet, by the side of Sergeant G. A. Shoemaker, who released Bing's chute at the proper time. The chute opened nicely and Bing had a pleasant journey down, landing in the arms of Lieutenant J. L. Stromme, who has the distinction of raising Bing from a blind pup. Bing was none the worse for the journey and proclaimed in dog language its merits when once again he set foot on terra firma. This adds the title of "Expert Jumper" to Bing's rating of "Aeroplane Observer." This jump created much interest in San Antonio and the vicinity and a large crowd assembled at the Field to witness the jump.

Washington Merchants Co-operating With Engineering Division

Appeals to real estate men and individuals to co-operate with the manufacturers' sections of the Merchants and Manufacturers' Association of Washington, D. C., in securing a location for the flying field for the engineering branch of the air service in Washington, were made by Charles J. Columbus, secretary of the trade body. The flying field of this branch of the air service now is located in Dayton, Ohio.

Melvin P. Hazen, surveyor of the District, it was announced, is lending his cooperation in trying to find a suitable area for the flying field, and to list the locations with the Merchants and Manufacturers' Association.

The specifications for the flying field which the air service has furnished the merchants' association contemplates a reasonably level area one mile wide and two miles long, preferably within touch of the city service, such as railroad transportation, water, sewerage, and electricity for light and power.

Navy Sends Appeal for Lost Balloonists

The naval radio carried "Q S T" messages asking all ships and stations to keep watch for the three Lieutenants missing since they went aloft in a free spherical balloon at the Rockaway Point Naval Air Station December 13, for an experimental journey to Canada. Recruiting offices through the northern part of New York also were asked to keep a lookout for information of the men, and to relay it at once.

When eighty hours had elapsed and no word had been received since the information that the craft passed near Wells, N. Y., about eight hours after it started, officers at the air station admitted they were "uneasy, but not alarmed." They still backed the courage, ability and resourcefulness of the three: Lieutenants Walter Hinton of NC-4 fame; A. L. Kloor and Stephen A. Farrell, but admitted there was almost no possibility of the balloon, with its limited cruising radius, still being aloft.

Belief grew that the men were somewhere in the mountain wilderness of the Adirondacks or stranded in some little-inhabited part of Canada and that clad in their warm flying clothes they slowly were making their way toward some point of communication.

FOREIGN NEWS

The Zeppelin for Italy

The Zeppelin "L-120" on November 19 left her station at Seerappen, Koenigsberg, for Stolpe in Pomerania, where she will be handed over to representatives of Italy, to which country she has been assigned. The hangar at Seerappen has also been assigned to Italy; it is to be taken down, transported to Milan, and re-erected there to house the "L-120," which claims to have made a duration record of 105 hours.

An Aerial Derby in Australia

The first Aerial Derby to be held in Australia took place on November 27 over a triangular course starting from the Mascot aerodrome at Sydney, going to Camden, thence to Richmond and back to Sydney. The winner was Capt. Matthews on a Sopwith G.N.U., who covered the 64 miles in 42 mins. 54 secs., while Lieut. Love, on an Avro, won the handicap.

Fédération Aéronautique Internationale

At a meeting of the Committee of the Royal Aero Club held on Wednesday, November 17, it was reported that the Bureau of the Fédération Aéronautique Internationale would meet in Paris on January 10 next. It was decided to defer sending in the items for the agenda until the Joint Standing Committee of the Club and the Society of British Aircraft Constructors had fully considered the proposals for next year's Schneider Race and the speed race to replace the Gordon Bennett Race. The conditions of the Federation Aeronautique Internationale Superior Brevet were considered.

Two Vickers-Vimy Seaplanes for Canada

The Canada Steamships Lines have purchased in England two Vickers-Vimy seaplanes capable of carrying 12 passengers each for an aerial service between Montreal, New York and Toronto—to be started next summer.

Expenses on French Part of Paris-London Air Route

In the course of a statement in the French Chamber recently, the Assistant Secretary of Aviation stated that the cost of upkeep of aerodromes, hangars, repair shops, meteorological and wireless stations on the French portion of the Paris-London service was estimated at 20,000 francs per kilometre as against the cost of 50,000 francs per kilometre for a single line of railway. He thought that in future the total cost of organizing an aerial service would be 10,000 francs per kilometre. On the other hand, he emphasized the difficulties due to present heavy charges on flying plant, the French calculation of the life of an aeroplane being 200 flying hours, which meant that about 3.50 francs per kilometre had to be added to the total cost of the service. This, however, he had hopes of seeing reduced.

Prome Aerodrome, Burma

The Burma Government, in view of the projected air service between Calcutta and Rangoon, has decided on the immediate construction of an emergency aerodrome in Prome, about 160 miles north of Rangoon. The site selected by the Royal Air Corps is the former Prome race course, about two miles south of the town, and measuring approximately a square of about 600 yards. It is now overgrown with jungle, which the Department of Public Works is engaged in clearing. It is expected that the new aerodrome will be completed by March, 1921.

Toulouse-Barcelona-Casablanca

The importance of the bi-weekly air service between Toulouse-Barcelona-Casablanca-Alicante-Malaga-Tanger-Rabat-Casablanca, started by M. Latécoère in 1919, is shown by the fact that from September, 1919, to September, 1920, 454,686 kilometres were covered and 1,065 passengers carried without a single accident.

Peking-Shanghai Air Mail Service

The Chinese Government has sanctioned the inauguration of an air service between Peking and Shanghai, with three intermediate stations and 80 landing grounds. It is hoped that after carrying the mails for six months a public service will have been secured which will carry both passenger and goods traffic. From Peking to Shanghai is 700 miles.

Scheme to Minimize Landing Dangers

The French Ministry of Marine is trying, on board the uncompleted battleship, "Béarn," which is being fitted as an aeroplane-carrier, a new scheme to minimize the danger of aeroplane landing on deck.

Classification of Machines for Racing

At a meeting of the committee of the Royal Aero Club it was decided that the Racing Committee should formulate the club's suggestions for the classification of machines for racing purposes.

The British Royal Household and Aerial Photography

A month or two ago H. R. H. The Duke of York very graciously accepted an aeroplane photograph of Windsor Castle, taken by Messrs. Aerofilms, Ltd., of the London Aerodrome, Hendon, N.W.9. Her Majesty the Queen saw and admired the photograph in the Duke's residence and asked if a copy could be secured for herself to hang in the library at Windsor Castle, and Messrs. Aerofilms were honored with a request to supply same, together with an additional copy illustrating a further position of Windsor Castle, to make a pair of pictures for the library.

Messrs. Aerofilms, Ltd., who are the pioneers of aerial photography on a commercial basis in the United Kingdom, have, since the war, been extremely active in securing fine pictorial results all over England. At the present moment aerial photographic survey is being used extensively by enterprising Town Councils and estate agents for assisting in the developing of town planning and housing schemes. Also aerial survey parties are being arranged for work abroad, on plantations and undeveloped land where no ground survey has yet been made. It is found that by surveying large areas from the air, only taking a month or two to complete, makes a saving of some thousands of pounds over the cost of ground surveying, which takes years to complete, according to the area to be covered.

Aeronautical Research

Air-Commodore R. Brooke-Popham, Director of Research, Royal Air Force, delivered a lecture on "Aeronautical Research" in the Engineers' and Shipbuilders' Institute, Glasgow, on Thursday, November 18, to the members of the Glasgow Branch of the Scottish Aeronautical Society. The lecturer outlined the difficulties which were encountered in the development of both aircraft construction and navigation. Dealing with the question of engine trouble, he said that in all the accidents that had occurred to aircraft since the Armistice it was found that approximately half were caused by engine failure. Of these 80 per cent. were due to what he termed "engine accessories," and only 20 per cent. to the engine itself. They had been unable to obtain a really satisfactory flexible joint for petrol pipes, and that was necessary to absorb the vibration. With regard to the ignition system, the only satisfactory way to get over the difficulties was to do away with it and use some modification of the Diesel principle. One of the many advantages of that would be the possibility of using a much heavier fuel, which would not only be cheaper, but be a good deal safer. In the construction of the body designers in this country were tending towards a very thick wing section, which would be able to contain the engine, petrol tank, and possibly passengers. A big German monoplane, which it was hoped to fly across the Atlantic shortly, was somewhat of this type.

A Fine Flight in Ecuador

During the Ecuador centenary celebrations the airman Elias Liut accomplished a daring flight, reports *The Times* correspondent at Quito. He started at Guayaquil and descended at Riobamba, after touching at Cuenca. The airman flew over Mount Chimborazo at a height of over 20,500 ft., and dropped flowers of the French and Italian national colors. Descending at Riobamba, he was pulled from his machine and carried in triumph through the town.

Aircraft Production in Germany

It is stated from Berlin that Air-Commodore Masterman, the president of the Inter-Allied Aeronautical Commission in Berlin, notified the German Government on November 16 that the Ambassadors' Conference decided on November 3 to consider the Spa protocol of July 12 as annulled, and the Boulogne decision of July 27 as being still in force. It may be recalled that the Boulogne decision prohibits the manufacture and importation of aeronautical material until three months after Article 202 of the Peace Treaty has been carried out.

Article 202 of the Peace Treaty provides that, on the coming into force of the Treaty, all German military and naval aeronautical material, except the machines mentioned in the second and third paragraphs of Article 198, must be delivered to the Governments of the principal Allied and Associated Powers. Delivery must be effected at such places as the said Governments may select, and must be completed within three months.

A Competition for Norway

An international competition for aeroplanes, the first to be held in Norway, is being organized to take place during the Northern Sports week, in February next. It is anticipated that there will be some entries from Finland, while some new ideas in the way of chassis specially designed for landing on snow and ice should make their appearance.

Holland to Encourage Civil Aviation

With a view to speeding up the development of civil aviation in Holland, the Royal Aero Club of Holland has appointed a Committee for Aerial Touring. Among the items which are put down for its consideration are: Modifications of the International Aeronautic Convention to facilitate aerial touring; study of the best machines for touring; competitions; development of aerial routes; research work on signals, etc.; simplification of customs formalities; means for popularizing aerial touring.

The Holland-Java Flight Off

It is announced from Amsterdam that the proposed flight of an escadrille of flying boats from Holland to Java will not be proceeded with, at any rate for the present. Lieut. Koppen, who was to have led the adventure, is now busy arranging for a flight across Europe.

Aerial Survey of Calcutta

At a meeting of the Calcutta Improvement Board it was decided to approach the Handley Page Company with the view of obtaining an estimate for the aerial survey of Calcutta. It was also resolved to consult the Corporation as to their willingness to join in the undertaking.

Air Service for South Africa

The scheme for an air service to embrace the whole of the Union of South Africa has so far progressed that a company is at present in course of registration in London. It is now proposed to carry passengers and mails, as well as goods, although the original scheme was to carry mails and parcels only. "Airco 16" machines will be used, to carry sixteen persons, or, in case of goods, 2½ tons. All machines will be fitted with wireless telephony, for which the assistance of the Government is being sought, with a view to building wireless land-receiving stations. Capt. Victor Kelly was expected to leave England with the first consignment of machines at the end of October, but it is now possible that these arrangements will have to be altered. The journey to Durban from Johannesburg will be done in four hours, and the return fare will be about £10. Colonel R. de Sarigny, who is in charge of operations in Johannesburg, says the company has secured provisional contracts with every firm of standing in that city, and that the Chamber of Commerce has expressed its recognition of the need of a fast parcels traffic for the purpose of delivering to country centres and bringing goods urgently needed by Johannesburg establishments from the coast.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Detailed Description for Building a Flying Scale Model of the Verville Racing Biplane

(*Continued from page* 401, *December* 20, 1920, *issue*)

CONTINUING our description of the Verville model from the previous issue of AERIAL AGE, in which a large outline drawing was presented, we will take up the various parts in detail.

We will assume that the builder has redrawn the outlines at full size for only in this way can the most favorable results be accomplished.

The most unusual feature of this model is the fuselage which is formed of balsa wood. This wood. as most of our readers probably are aware, is the lightest wood used for commercial purposes. It is used on full sized aeroplanes for stream lining and covering in various parts of the plane where a certain outline must be obtained, and, at the same time, where strength is not required..

The model builder's first attempt at using this wood might be rather awkward, but once he becomes acquainted with its nature he will soon find that it is easy to work with and makes the most pleasing outline.

Fuselage

The balsa block for the fuselage should be 22½" long and 3¾" square in section. Paper patterns should be made for the side outline (not including the fin or the pilot's headrest) and for the top view (not including the engine blocks). The first step is to carve the solid block down to the proper outline and to finish off smooth. It would be well to give this a coat of shellac before proceeding further. The next step would be to cut the body in two parts lengthwise through the side and to gouge the interior so that there will remain a shell having a wall approximately ⅛" in thickness throughout. Where the lower wings are run underneath the body, a portion of the fuselage should be cut away. In hollowing out the interior of the body it will be necessary to provide for this indentation so that the necessary material will remain for the fuselage wall. The interior should be smoothed out well, sandpapered and shellacked with a thin coat which adds to the strength. An opening can be made in the top for the pilot's cockpit, which, at the same time, gives access to the interior for fastening the motor stick in place. The halves of the fuselage should be replaced and set permanently by using hot glue. (Make sure that all parts of the balsa wood to which glue is applied are sandpapered free from shellac, otherwise the glue will not hold.)

The hollowed fuselage makes it inconvenient for attaching the rubbers and for that reason the forward section from the pilot's seat to the propeller can be made removable.

A balsa wood nose plate or "spinner" built in two parts is attached to the propeller hub and made to continue the fuselage streamline. The spinner, of course, revolves with the propeller.

To complete the fuselage the balsa wood fin, headrest and the dummy engine are glued in place after which the entire fuselage can be shellacked.

The stick for carrying the rubber strands is 15" long of 3/16" x ⅜" spruce with a hook at the rear and a propeller bearing at the forward end. This stick is fastened at the forward end and to a cross strut run through the fuselage just forward of the pilot's seat. To prevent twisting of the body, this stick should not be fastened near the rear end.

A definite number of rubber strands cannot be given, for this will vary with the weight of the machine and the accuracy with which it is built. ⅛" x 1/16" flat rubber is recommended. It can be made to run smoothly by giving it a generous application of talc or soapstone.

Wings

The upper wing is made in one piece; the lower wing is also made in one piece. Both wings are tapered slightly and for this reason it will be best to use light bamboo ribs fastened to the main spars with glue and silk thread. Leading edge of light bamboo or ⅛" round reed. Main spars ½" x ⅛" at the center and tapered down to ⅛" square at the ends. The trailing edge can be of light steel wire, or, if this it not available, ⅛" round reed may be used.

It will be noted from the drawing that the ailerons are on the lower wings only. Ailerons can be made separate, but for a flying model greater lightness will be obtained by merely making the aileron outline and building the surface right into the wing.

The struts between the wings are of spruce ½" by a little less than ⅛". The ends can be covered in with balsa so as to obtain the streamline effect. The drawing shows small blocks glued to the wing spars for attaching the struts. The struts from the body to the upper wing can be made of ⅛" round reed or bamboo.

Surfaces should be covered with China silk, doped in the usual manner. The best color would be tan. (This applies also to the tail and rudder covering.)

Tail Surfaces

The horizontal surfaces (stabilizer and elevators) can be made in one piece in order to obtain lightness. The principal spars are 3/16" x ⅛" tapered at the tips. The outline is made of light steel wire. Ribs of bamboo bound to the spars and to the wire edges.

The rudder can be built up with a wire edge outline and bamboo ribs, or it can be made of solid balsa wood like the fin.

Landing Gear

A pair of 2" wheels are used. Axle 5½" long with ends threaded for nuts. The under carriage members consist of two "Vs" of ⅛" round reed.

The tail skid is of spruce arranged to have the rudder clear the ground by ¾" when the machine is at rest.

Propeller

The propeller is 10" in diameter carved from a block of white pine ⅝" x 1". It is important to see that both blades of the propeller are evenly balanced for if they are not it will cause vibration which tends to rack the machine and distort its flying qualities.

Wiring

The bracing wires should be made of light tinned steel wire or piano wire. The drawing shows the proper location which is somewhat unusual; one wire runs from the top of the landing gear to the top of the wing struts. Wires also run from the lower ends of the struts at center section to lower ends of wing struts.

General Directions

When all rigged for flight see that the model balances at a point about 2¾" from the leading edge of the top wing. (This is about ⅝" in back of the main spar.) From this position the wings can be moved forward or backward as necessary to obtain correct flying balance.

It is well to glide the model through the air launched from the hand before attempting a power-driven flight; in this way it is easier to detect an improper balance, for if the machine is "nose heavy" it will dive quickly, and if "tail heavy", the tail will drop. This condition can be overcome by shifting the wings forward in the former case and backward in the latter case.

Scale Models Built by Readers of the Elementary Aeronautics Page

Photographs of two fine scale models, built from descriptions on this page, have been sent in by Bruce A. Mapes, of 2274 Cropsey Avenue, Brooklyn, New York. The Loening monoplane weighs 11 ounces. Ribs and dummy motor of balsa wood. The other model is of the De Haviland type with all workable controls. Both models fly well.

C. J. Balassa, 209 Bay 31st Street, Brooklyn, New York, who has been making models for three years, recently completed a Nieuport Scout, a Caproni biplane and four models of the Standard E-1 Secondary Training Plane. The Standard models, made with the assistance of a friend, fly from 50 to 100 feet when hand launched.

A Loening seaplane model has been designed, built and flown by Edward Walker, of Rockwell, Texas. Several good flights have been made with it. Its span is 34 inches. An 11-inch propeller is run by 38 feet of flat rubber, giving a flight of 185 feet. Mr. Walker has also built a neat 36-inch scale model of the Curtiss JN-4B; it is not intended to fly, but is provided with an electric motor and miniature lights, making an attractive window display.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Anything Possible These Days

"Impossible."

"But I saw it."

"Impossible—ridiculous!"

"I tell you it did."

"And I say it didn't, because it couldn't."

"I was there and witnessed it."

"Do you mean to tell me that he was killed by a bolt from a clear sky? Do you expect me to believe such a yarn?" he shouted.

"That's just what I'm telling you. The bolt dropped from a passing aeroplane."

Zipp—Why does an air pilot never have to blow his nose?

Yipp—Because it's blue, I suppose.

Aviator—Yes, they got twenty-four bullets out of me! They ought to have sent me to a munitions depot—not to a 'orspital!

1st Mechanic—Why do you smoke such a long pipe?

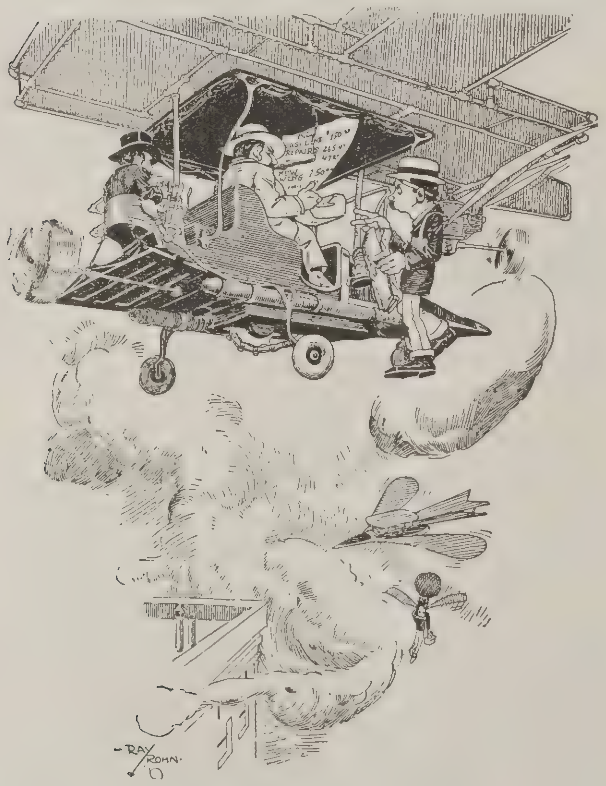
2nd Mechanic—I am trying to keep away from tobacco.

Place of Honor

"Yes, Jones, the glide expert, is a prominent member of our fraternity."

"What's his official capacity?"

"Oh, several gallons."—*Siren.*



EXPENSIVE.

Mr. Bunk (reading bill for airship repairs)—"The high cost of living is bad enough, but it can't touch the cost of high living."

At the Gate of the Field

1st Private—They say the Dean is losing his mind.

2nd Private—I shouldn't wonder. He gave me big pieces of it a number of times.

Hopeful

Aviator (who puts up at a farm house over night)—Splendid morning, sir.

Grouchy Farmer—Naw, it ain't. It's rainin' pitchforks.

Aviator—Well, cheer up, they'll come handy for the hay later on.

Down South with the Exhibition Flyers

"Ah got a horrible shock, yistiddy."

"Howcome, honey, howcome?"

"Why, ah wuz eatin' a piece of fruit cake and a big currant passed right froo mah mouf."

So Say We All of Us

1st Aviator—I have a friend who suffers terribly from the heat.

2nd Aviator—Where does he live?

1st Aviator—He isn't living.—*Lehigh Burr.*

Our Platform

If any one has—
Died.
Eloped.
Married.
Divorced.
Left town.
Embezzled.
Had a fire.
Sold a farm.
Had a baby.
Been arrested.
Come to town.
Bought a home.
Committed murder.
Fallen from an aeroplane.
That's news—Telephone us.
—*The York* (*S. C.*) *News.*

Dear Old Lady—My dear sir, how well you swim. Where did you learn?

Lifeguard—Well, you see I was a traffic policeman at Venice.

Frantic Aeroplanist—Oh, officer! someone has stolen my spark plugs.

Officer—Are you sure ye had 'em when ye left home?

Prof. in Math. Class—There are two aeroplanes going in the same opposite direction, one fifty miles an hour and the other at sixty. How far apart will they be when they meet?

Mechanic—Ever have any money left you?

Friend—Yes, and it left me quick.

Old Lady Customer—Do you guarantee these nightgowns?

Sly Young Clerk—They can't be worn out, madame.—*Stanford Chaparrel.*

She (thoughtfully)—Do you ever think much about reincarnation, dear?

Mechanic (otherwise)—Think about it? I eat it nearly every day—only we call it hash.

AERIAL AGE
WEEKLY

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Photo by U. S. Army Air Service

The Washington Monument and Tidal Basin at Washington, D. C.

World Aerial Derby Plans Progressing

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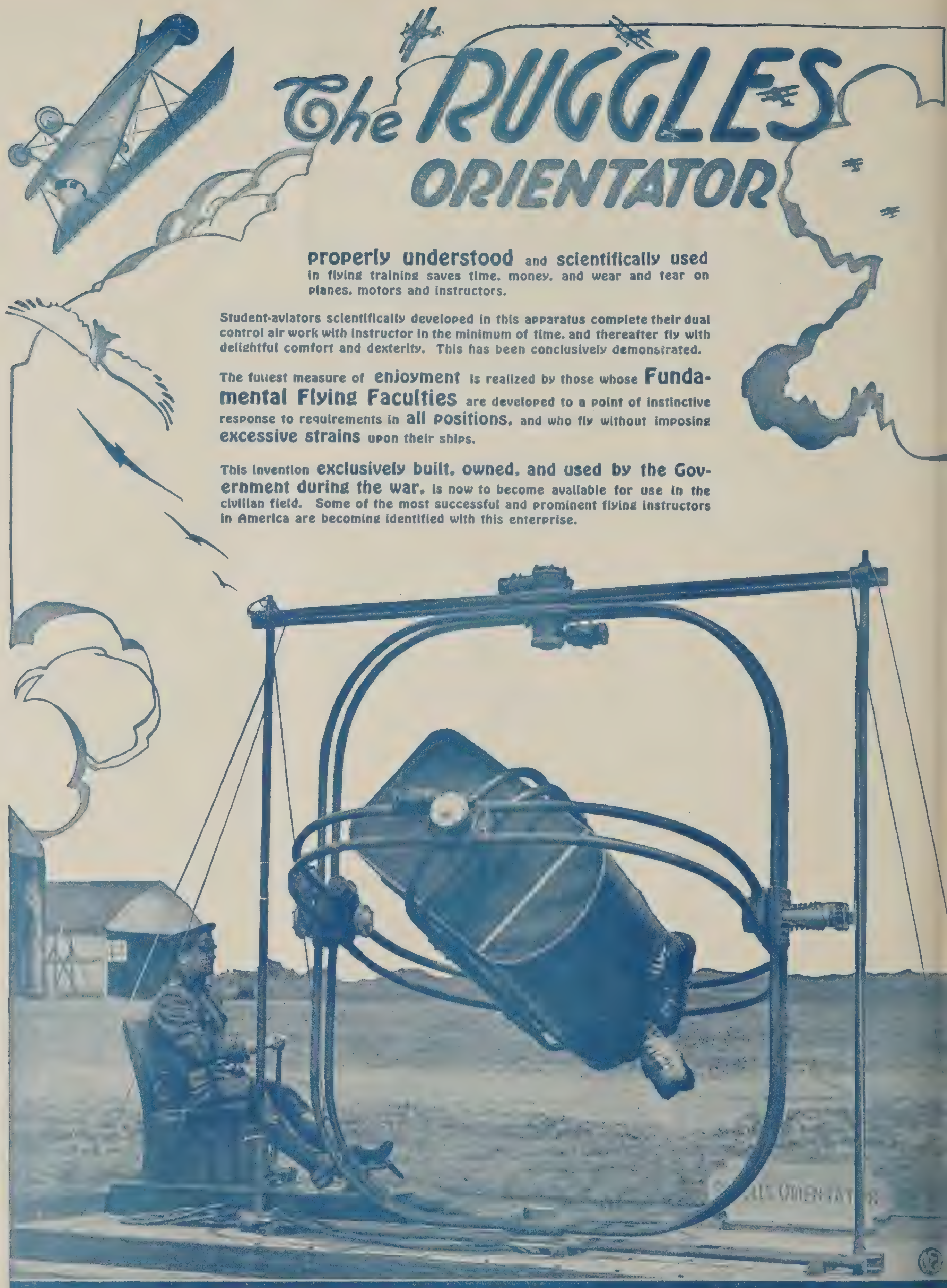

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Student-aviators scientifically developed in this apparatus complete their dual control air work with instructor in the minimum of time, and thereafter fly with delightful comfort and dexterity. This has been conclusively demonstrated.

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WORLD AERIAL DERBY PLANS PROGRESSING

PLANS for the Aerial Derby Around the World which was suggested at the last meeting of the Interallied Aeronautic Federation in Geneva are beginning to take shape, it is learned from members of the Aero Club of America, who said that they were expecting to receive suggestions for rules for the race from the Aero Club of France.

It is expected that the final set of suggestions on which a specially appointed committee of the French club has been working since the Geneva meeting will be received here very soon. As soon as they are receivd the contest committee of the Aero Club of America, of which Caleb Bragg is chairman, will consider them with the idea of deciding on the feasibility of a round-the-world race.

The International derby plan was thoroughly investigated early this year by a committee headed by Louis D. Beaumont and Major Charles J. Glidden, which toured the world. It was submitted to the meeting at Geneva and then was placed in the hands of a special committee of the Aero Club of France. Since the idea was originated by Americans, it was decided that this committee, in conjunction with the Aero Club of America, should make the final decision.

The suggestions made by the French committee have already been sent to America, according to a cable despatch from Wythe Williams to the Philadelphia *Public Ledger*. The suggestions, according to the despatch, call for a first prize of $1,000,000 and other prizes of $2,000,000 to be furnished by the various countries participating.

The race is to start July 1, 1921, must be flown between 15 and 60 degrees north and must be finished in 100 days, no matter when or in what direction the planes start. The winners will be decided by the number of degrees flown in the shortest time. Any size of aeroplane or dirigible may be entered. Control points will be established all over the world and pilots will not be allowed to skip more than one at a time. In America the controls will be at New York, Chicago, Omaha and Seattle.

The $1,000,000 prize will be given only if a flight around the world is made entirely by air.

It is understood abroad that France will enter a dozen new types of planes, while Italy will enter a dirigible capable of remaining in the air for twenty days.

America and German Aircraft

One of the leading British aeronautic journals has some interesting comment to make on alleged arrangements being made to import into America large quantities of German machines.

"Reports emanating from Berlin state," says the editorial, "that 400 Junkers monoplanes have been purchased by the Americans, and that their delivery has been prevented by the Inter-Allied Commission of Control. The operations of the Zeppelin Company have also been hindered by the Commission, and the proposed trans-Atlantic Zeppelin service seems to have fallen through, since the Germans may not build the Zeppelins at home and will not do so in America. It is not surprising that American enterprise in aeronautical directions should have turned to Germany, as owing to the condition of the country, there is very little opportunity for the development there of the great industry built up during the war, and the present rate of exchange is very favorable to the purchase of German goods.

"The Inter-Allied Commission are, of course, perfectly right to hold Germany to the terms of the Treaty, and, no doubt, they have to be pretty sharp to prevent its being evaded, but such hampering of German aircraft development must of necessity be only temporary and in the future we must expect that great developments will take place, very likely in co-operation with American enterprise. We must be prepared on our side to compete with it, which we are well able to do if our manufacturers get sufficient encouragement."

American manufacturers will be glad to learn that the prospective market for aircraft in the United States is so alluring to our foreign competitors.

The Helicopter in Europe

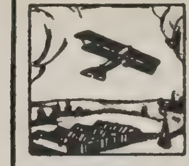
When M. Damblanc read his paper on the helicopter before the British Royal Aeronautical Society, the keen interest aroused and the large attendance at the meeting was surprising.

It has, of course, long been recognized that the problem of the helicopter is not simply to rise into the air by direct lift. That would have been done long ago, and would in itself have been perfectly useless. The problem is to travel horizontally when the machine is up, and to descend safely without the use of engine power.

It requires no expert to estimate the advantages of the helicopter. They are obvious, though perhaps the full force of them is not yet realized by most people. The alighting difficulty is the great handicap that the aeroplane has suffered from since the very beginning, and little has been done to meet it.

It is quite beside the mark to criticize the helicopter on the ground of its being less efficient than the aeroplane. M. Damblanc's helicopter is in an earlier stage of evolution than Wilbur Wright's aeroplane, and if it is equally successful M. Damblanc will be worthy of much honor. Wilbur Wright soon came to the conclusion that his difficulty was not so much in getting off the ground as in controlling the aeroplane when it was in the air and in alighting safely, and M. Damblanc has a similar problem to solve. How he proposes to maintain the stability of his machine he did not divulge, but he proposes to descend (in case of engine failure) by declutching his engines, which will be done automatically when the revolutions fall off, reversing the incidence of his propellers and using them as an air-brake. The constructional difficulties in effecting this are great, especially as the operation will have to be carried out in the shortest time possible to avoid disaster. Reversible pitch propellers have never come in for aeroplanes, in spite of their advantages, on account of difficulties of construction.

However, if it is rash to assume that M. Damblanc has solved the problem of the helicopter, it would be rasher still to assume that the problem is unsolvable.



The News of the Week

Curtiss Eagle Makes 18-Hour Endurance Flight

Lieut. Ross C. Kirkpatrick, after being in the air over Mitchel Field on Long Island since 7:30 o'clock December 21st, in an effort to make a sustained flight of thirty-six hours, was compelled to land Dec. 22nd at 1:36 A. M. because of a leak in his gasoline tank. Lieut. Kirkpatrick was therefore in the air 18 hours, 6 minutes. Had he succeeded in flying for thirty-six hours he would have established several new world's records.

Through the day the aeroplane attracted no attention because a ship in the air in the vicinity of Mitchel Field is nothing new. But last night, when darkness came, the race between time and the machine's gas supply took on a weird aspect. The aeroplane became a shadow, dáncing across the banks of mackerel clouds and occasionally cutting across the face of the moon. From time to time Lieut. Kirkpatrick swooped down in wide spirals, coming to within 200 feet of the field, only to climb back to the altitude from which he started. His plane carried no lights and was invisible except when it swung into the illuminated sector of the sky.

With Lieut. Kirkpatrick was Max Goodenough, an old army flier. Goodenough served as mechanician for the flight and alternating with Lieut. Kirkpatrick as pilot.

The ideal conditions of wind under which the flight was made had failed to blind Major Arthur Christie, commandant of the field, to the possibility that in the intense cold both pilot and mechanician might find the suffering unbearable and make a forced landing. The men took with them eight quarts of hot coffee and a supply of sandwiches. The only other baggage was a supply of extra clothing, necessary because the small size of the plane's cockpit and the fact that it was not heated rendered the driving of the machine a cold and uncomfortable job.

At six o'clock in the evening six big flood lights were placed around the margin of the landing field to guide the aviators, should they find it necessary to descend, and to show them the limits of the circular route they were ordered to follow in the flight.

When the flight started Major Christie and Major Henry Miller, adjutant of the post, as well as other junior officers, were on the field. After the plane had circled the field a dozen times and the race was well under way, all but the official observers for the War Department disappeared, and Lieut. Kirkpatrick and his mechanician were left to themselves. It was explained that the flight was ordered by Major-General Menoher, commanding the Army Air Service, and that it was expected the aviators would demonstrate fully what an American-made aeroplane and motor could do when called on to make an unusual effort.

The plane used for the test is one of the Eagle type and was constructed at the Curtiss plant for passenger service last summer. For the purposes of the flight the passenger compartment was redesigned for gasoline and oil storage, and when the ship took the air its tanks contained 590 gallons of gasoline and forty of oil.

The wing spread was sixty-one feet and its length thirty feet. Its motor is one of 400 horsepower Liberty engines, burning about eighteen gallons of gasoline an hour.

Society Interested in Air Travel

Reports to the Manufacturers' Aircraft Association from operating companies in the South indicate that society is manifesting an increasing interest and confidence in travel by air. The latest word to this effect is from the Aeromarine West Indies Airways, Inc., which reports the transportation over the week-end (Dec. 18-20) of Lord Waldorf Astor and party of nine from Miami to Bimini. The distinguished tourists chartered one of the Aeromarine Navy Cruisers, fourteen-passenger capacity, operating regularly between Florida and West Indian ports.

Doubts Lost Balloon Crossed the Border

With the Canadian Air Board co-operating with Army and Navy agencies and the State rangers, the intensive search for the Navy balloon A-5598, missing since it left Rockaway Point Air Station a week ago Monday, has been continued without success up to the time of writing. No word of the balloon, which carried Lieut. Walter Hinton, Lieut. Stephen A. Farrell and Louis A. Kloor, Jr., has been received by their anxious comrades at Rockaway.

The Canadian Air Board expressed doubt that the airship had crossed into Canada, as many messages of inquiry had been sent by it to points throughout the Ottawa section several days ago and no replies had been received. Lieut. A. W. Evans, in charge of the Navy's search, said he was working on the theory that the A-5598 did not land in the Adirondacks, but had drifted into the region north of Ottawa.

From Glens Falls came a report that the army De Haviland plane flown by Lieut. L. V. Beau had scoured 300 miles of territory over the Adirondacks. Lieut. Beau said he could find no trace of the missing balloon.

Residents of North Hero, Vt., on an island in Lake Champlain, believe the naval airship passed over there on Sunday night. Several persons reported seeing an airship, brightly lighted, going in a southwesterly direction and flying at a low altitude toward Plattsburg, N. Y. In support of the belief that the craft was a balloon they declared they heard no sounds of motors.

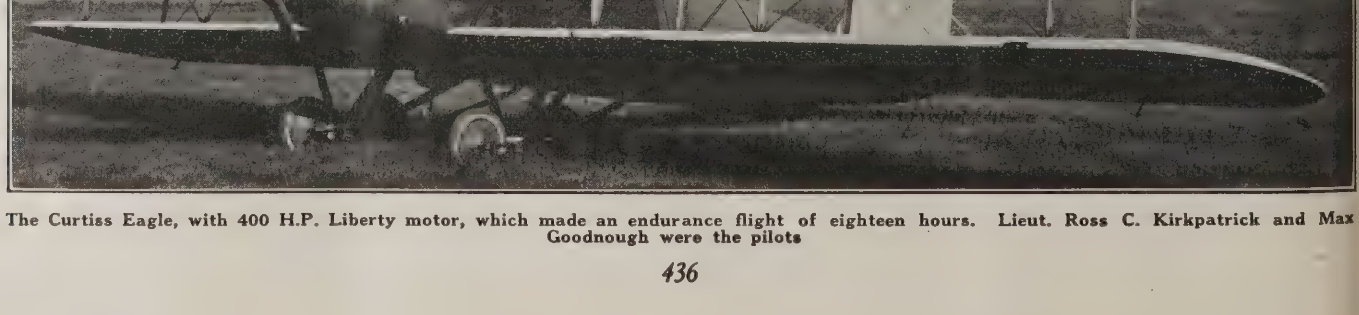
Aerial Mail Service Passes Test in Mexico

Vera Cruz—An American aeroplane driven by Fernando Proal, a Mexican aviator, with Augustin Henriquez as mechanician, flew from Mexico City to Vera Cruz, the distance of 225 miles being made in two hours and twenty minutes. The principal object of the flight was to determine the feasibility of an aerial mail service between Mexico City, Puebla and Vera Cruz. The flight was so successful that regular service probably will be established in February or March.

The aviators left the Mexican capital at 7.10 o'clock in the morning and at 9.30 alighted here, having made the trip without incident and maintained a speed of approximately ninety-six miles per hour.

Personal Pars

Howard Huntington, pioneer aeroplane inventor and formerly secretary of the Aero Club of America, was married to Miss Anna Erica Logan at Ridgewood, N. J., on December 20. Mr. and Mrs. Huntington will reside at Miami, Florida.



The Curtiss Eagle, with 400 H.P. Liberty motor, which made an endurance flight of eighteen hours. Lieut. Ross C. Kirkpatrick and Max Goodnough were the pilots

Exhibits and Entries at Long Beach Air Tournament and Show

Following is a list of exhibitors and race entrants in the Winter Air Tournament and Show at Long Beach, Cal.:

Army, Curtiss, gunnery and instruction planes, bomb-dropping devices, wireless, electric-heated clothing, aviation instruments, Renault, Wright, Sturtevant, Austro, Dainier, Liberty, Wright Hispano, Lerhone motors, Browning Vickers, Martin, Lewis machine guns, cameras, pigeons, balloon baskets with instruments.

Navy F-5-L, Curtiss F-R-6, Boeing, seaplane, Davis gun and machine guns.

The Commercial Exhibit includes the Pacific Hawk, six-passenger plane, built by George F. Stephenson, standard aeroplanes, a Junker and others.

Twenty-two entrants have signed up for the races, which include a hundred-mile free-for-all. The prizes are the Hayes Challenge Trophy and Liberty Bonds. There will also be handicap races.

The entrants are: Captain L. N. Smith, Hall-Scott Fokker; Lieut. William D. Coney, Spad; Cadet Lyle H. Scott, Boeing Liberty; Sergeant T. J. Robins, De Haviland; Lieut. Frank W. Seifert, Lapere; W. G. Goldsborough, De Haviland; Lieut. E. C. Batten, Lepare; Lieut. Harold Brand, De Haviland; Milo N. Clark, De Haviland; Ned Schramm, De Haviland; Lieut. R. N. Ott, S-E-5; Lieut. Younger A. Pitts, De Haviland, all above army entries; Earl S. Dougherty, Polson Special; Frank Clarke, Hall-Scott Fokker; G. G. Budwig Waterman, Lepere; Lieut. Lee Foster, S-E-5, all above also in sixty-mile handicap the following day, except Foster, with following addition: Lieut. A. W. Smith, J-N; R. S. Worthington, Lepere; E. C. Whitehead, Thomas-Morse, from Army, and E. H. Rogers, Canadian Curtiss, and W. D. Timm, Banchart biplane; John G. Montijo, Kinner Airsteer; E. H. De Lay, De Lay biplane; David E. Thompson, J. L. monoplane; E. L. Remelin, triplane; C. T. Wilkinson White, B. R. T.; Fred D. Hoyt, Hoff biplane.

Aeroplane Takes Santa to Nation's Capital

Washington.—Santa Claus because of lack of snow discarded his traditional sleigh and reindeers and arrived by aeroplane. Escorted by two other planes, each bearing gifts, he arrived at the Polo Grounds and assisted by soldiers distributed toys to hundreds of children who had gathered in anticipation of his coming. It was said he had obtained a loan of the aircraft from the War Department.

Aeroplanes in Oil Fields

Edmonton, Alberta, is preparing for the first rush by aeroplane to the petroleum fields near Fort Norman, on the Mackenzie River, nine hundred miles toward the frozen North, heralded by Dominion surveyors as richer than the oil lands of California.

San Diego Mail Service

With a view to establishing aerial mail service between San Diego and New York, John A. Jordan, chief of construction of United States aerial mail service, made an investigation in San Diego of conditions. The service, if found feasible by Jordan, will be a 52-hour service between San Diego and New York and will be by way of an air route from San Diego to the transcontinental mail terminal at San Francisco. He made the investigation under the direction of the Post Office Department.

China Pays Instructors $900 a Month

L. E. Benoit has returned from an extended trip in China and Japan and reports a considerable amount of commercial flying in these countries. Mr. Benoit states that the Hong Kong Flying School is operating thirty-five ships and are paying $900 gold per month for instructors.

Aerial Police Make Arrest

Winnipeg.—A machine gun on an aeroplane manned by members of the Royal Canadian Mounted Police and private detectives December 23d riddled a plane piloted by Joseph H. Gladbury, alleged confidence man, forcing him to land near Winnipeg, and effecting his capture.

Gadbury, wanted in Britt, Iowa, on a charge of forgery and obtaining money under false pretenses, is being held in a Winnipeg jail. Police intend to return him to Iowa for prosecution.

Gadbury was an aviator serving in the World War. His home is in Tama, Iowa. Establishing himself in Britt and promising farmers of that community to build an aeroplane factory, Gadbury is alleged to have obtained approximately $18,000. He also is charged with passing worthless checks totaling $1,390, after which he started for Minneapolis and Winnipeg in an aeroplane.

Gadbury was forced to land at Emerson, near the Canadian border, where his ship underwent repairs. Meantime private detectives from Iowa were on his trail.

Arriving at Winnipeg these detectives obtained co-operation of the Canadian police and started from Winnipeg in an aeroplane to capture Gadbury.

En route to Emerson they met Gadbury in his plane and an aerial battle rivaling war exploits was staged.

The propeller of Gadbury's machine was damaged, the gasoline tank punctured and the fuselage riddled by machine-gun bullets before the fugitive landed and was captured, the police say.

Seattle-Victoria Mail

The first international mail service undertaken by the United States Government is between Seattle and Victoria, and Pilot Eddie Hubbard has had marked success in handling the mails between this city and the British Columbia port. His contract calls for carrying first-class letter mail to catch steamers leaving Victoria for the Orient and to bring mail from steamships arriving there. A saving of one to six days is made on mail handled by seaplane.

Aerial Photography Around New York

The New York *Evening Post* at the suggestion of its real estate editor has recently been publishing a series of aerial photographs taken by the Fairchild Aerial Camera Co. Some of the captions have invited the readers to attempt to find their own homes in the picture. A series of pictures were also taken for the *Bronx Home News* showing living conditions and transit facilities in that borough. There seems to be no doubt that aerial photography will be used to a great extent in the real estate business in the future, as features can be shown as clearly in no other way.

The Savoia Seaplane, winner of the International Schneider Cup Race, which was held at Venice on September 21, 1920. The seaplane is known as the S-12 and is equipped with a 450 H.P. Ansaldo engine. Com. Bologna piloted the S-12 over the required course of 200 nautical miles, with a load of 660 pounds in addition to the passenger and fuel. The photograph is published through the courtesy of Major J. E. Chaney, assistant military attaché of the American Embassy in Rome

The AIRCRAFT TRADE REVIEW

Col. Clark Joins Dayton Wright

Col. Virginius E. Clark, who has been the chief aeronautical engineer of the Army Air Service since July 1, 1915, has left the army and is to become the chief engineer of the Dayton Wright Division of the General Motors Corp. Col. Clark is one of the pioneer aviators of the Army Air Service, having been one of the original 1913 San Diego school of fliers.

A graduate of Annapolis, Clark left the naval service for aeronautics and was sent to Massachusetts Institute of Technology for a course in aeronautical engineering. He has been a military aviator since 1917. During the war Col. Clark was engaged in the engineering supervision of the design and construction of our military aeroplanes and went to Europe as a member of the Bolling mission. Colonel Clark was in charge of the organization and construction of McCook Field and was its first commanding officer.

Since the war he has been stationed at McCook Field, where he has been in charge of the design and planning section of the engineering section of the Air Service. He has been a member of the National Advisory Committee for Aeronautics, Joint Army and Navy Technical Board for Aeronautics and the Aeronautical Committee of the Society of Automotive Engineers.

Aeroplane Silencer Test

Geneva.—American Army aviation experts, headed by Major Burwell, are expected to arrive soon at Dubendorf, four miles northeast of Zurich, to attend a test of an aeroplane silencer invented by the Swiss engineer Birger, says a dispatch from Zurich. The Americans will fly from Coblenz to Dubendorf, the dispatch adds.

It is said that Americans may buy the patent for the silencer if the test proves successful.

Efficiency in Lubrication

Although issued free, with the compliments of Messrs. C. C. Wakefield & Co., Ltd., a twenty-four-page booklet dealing with the above subject deserves careful study, for apart from "Castrol," naturally a leading theme, it contains interesting facts about viscosity, specific gravity, flashpoint, emulsification and other matters, passing onward to power-house problems, estimating the power of steam or gas engines, and the initial combustion pressure of gas engines—each division being treated with technical precision, supported by illustrative formulæ. Insisting on the study of lubrication problems from the chemical aspect, it is stated: "Factors such as deposits caused by superheated steam, deposits in turbines, sludge deposits in electric transformers, difficulties in the lubrication of Diesel engines and air compressors, etc., are subjects on which considerable work has been carried on here and suitable oils evolved to meet the conditions." Supplementing this, we have the assurance that the Wakefield research department is at the service of interested parties.

New Directory and Market Data Book

Crain's Market Data Book and Directory of Class, Trade and Technical Papers, now on the press, promises to be of unusual interest to advertisers generally and users of trade and technical papers in particular. It not only lists all of the business publications of the United States and Canada, giving circulations, rates, type page sizes, closing dates, etc., but supplies a market analysis of each trade, profession and industry. Thus the reader is given the basic facts of each line in which he may be interested, including its buying power, buying methods, character of requirements, etc.

Ericsson Creditors Ask Additional Receiver

Buffalo—A committee representing the merchandise creditors of the Ericsson Mfg. Co. met December 10 to decide what action can be taken to save the corporation from bankruptcy. The plant now is being operated by receivers and an involuntary bankruptcy petition has been filed against it by three creditors with small claims. The receivers have declined to combat the allegations of bankruptcy, although the majority of the creditors are convinced the company is solvent and could be saved if efforts were directed along the right lines.

Boeing Company Active

Seattle, Dec. 27.—The Boeing Airplane Company of Seattle, which submitted three original designs of army planes in competition with many other manufacturers, received prize awards in all three cases.

The Boeing corporation was awarded a contract for three armored biplanes, which are an advanced type over the ten armored triplane machines now being built here for the United States Army. This biplane was designed by the Seattle manufacturers. The armored biplane is the highest type aeroplane yet designed for the offensive and defensive work of the Army. It is known as the BA-6. Up to the adoption of the Boeing design, the armored triplane was the leading type of plane being built for Army use, and it was being manufactured only in this city.

In the Boeing plant, where the triplane is being made up in an order of ten machines at present, the BA-6, or biplane, was designed as an advanced idea over the triplane, with these distinct differences, briefly:

It is equipped with seven machine guns and one 37-millimeter cannon, being the only type of plane in the United States in which machine guns and cannon are carried in combination. The biplane drops one plane over the old style triplane. The biplane drops the two-motor idea and adopts a single motor, 18-cylinder engine, known as the "W" type Liberty engine.

The armoring in the two planes has this difference, namely, while both foreparts of the fuselage are heavily protected with armor (where engine, controls and operators, along with the machine guns and cannon, are carried) the protection of the after portion is different. The triplane is protected with plywood, while the biplane has a protective covering of steel tubing, covered with fabric.

The type of army aeroplane being built —and to be built when the biplane manufacture also begins here—is the highest type aircraft for army purposes, because these two types are the only ones where the machine guns and the cannon are used in combination. No other manufacturer in the country is making this combination type, it is said.

Present at McCook Field, representing the Seattle corporation, were William E. Boeing, president; Edgar N. Gott, vice-president and general manager; and C. L. Egvedt, chief engineer. Mr. Egvedt had just returned from a six months' tour of aircraft manufacturing plants in Europe.

New Ship

A new monoplane has been invented at Berkeley, Cal. Four brothers, members of the Jacuzzi family of aeroplane builders, have constructed a new passenger-carrying machine.

Recently the machine, carrying the four inventors and a mechanician, piloted by George V. Grey, Alameda aviator, flew from Redwood City to Oakland, via San Jose, in twenty-five minutes.

International Exhibition at Prague

The president of the Czecho-Slovak Republic inaugurated the Aero-Exhibition in Prague recently. Members of the government, foreign diplomatists, general officers of the army, high dignitaries, members of the foreign colony and journalists were present. The exhibition was a marked success. There were twenty-one exhibitors showing sixteen military, sport and transport types of aircraft.

17 Concerns Bid on Government Contracts

Seventeen aircraft companies and corporations submitted bids on contracts for five experimental types of aeroplanes at McCook Field recently. The estimated cost of these new machines is $1,500,000. The types were single seaters, two and ten passenger ships for military service as battle planes, ground-straffing machines, day and night bombers and observation and training planes. Most of the representatives were from Eastern companies. The new planes will make up a large part of the development program of McCook Field, which ends June 30, 1921.

New Seattle Field

Thirty acres of the Sandpoint aviation field near Seattle have been cleared of timber and landing space for planes will be provided by March 1. The field, which is on Lake Washington, has been pronounced by army, navy and postal officials as ideally located. Recently the joint House and Senate naval affairs committee inspected it, preparatory to the preparation of the budget for the navy.

An effort is being made to have this developed as the aviation base of the North Pacific.

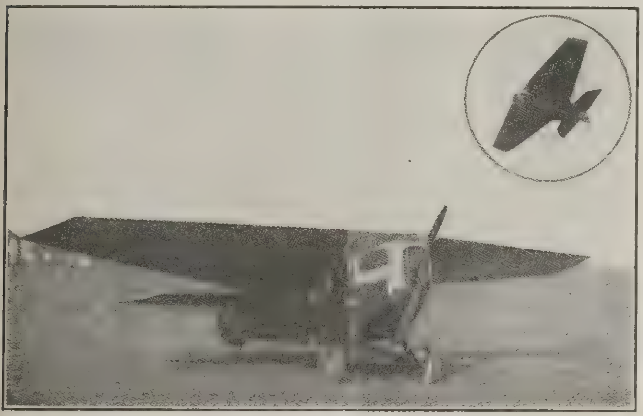
THE STOUT MONOPLANE

FLYING tests have just been completed by the Stout Engineering Laboratories on their new commercial type monoplane, an enclosed aerial sedan, which is a further development of the so-called bat-wing machine built by Mr. Stout for the government during the war.

This machine is a three-passenger, completely enclosed, internally trussed monoplane, having the wing mounted on either side and above the fuselage. It differs from previous aeroplanes in that the wings extend almost to full length of the fuselage at the center, though they taper to a very small chord at the tips.

The machine is built entirely of wood, even the wings being covered with very thin three-ply wood, glued on in panels. The wings are trussed inside with six lattice girders, also of wood and veneer construction, with the wing surfacing and batten ribs connecting the spars forming a unit monocoque wing said to be of unusual strength in proportion to its weight. While the weight is the same as that of most biplanes, the factor of safety is claimed to be more than doubled.

According to the designer, "the completed ship, while having thirty square feet more than the German Junker aeroplane, which is its nearest prototype, weighs almost 400 pounds less, while its structural strength by calculation is easily doubled. The total ship weighs 1,940 pounds empty, as against 2,380 pounds for the German ship. Its landing speed, however, is ten miles less and its maximum speed greater than that of the German plane. In the flying tests the plane flew at a maximum speed close to 120 miles an hour, yet made landings at 40 miles an hour."



The Stout Bat-Wing Monoplane

With the machine fully loaded, the wing loading is about 8 pounds per square foot, and the plane takes off the ground at about 50 miles per hour. It has a cruising radius of five hours. Its factor of safety is 8 and, in all fittings, 10.

The fuselage is of streamline form, built entirely of veneer. The first part of the structure is a keel, running fore and aft, to which are fitted bulkheads at specified distances in proportion to the stresses. These bulkheads are connected by battens or wooden strips, running fore and aft, to which the outside veneer is glued. This makes the entire fuselage, when completed and glued up with water-proof glue, practically a one-piece structure. The seats, flooring, etc., serve as a part of the structure, as well as for their normal uses.

The wings are attached to the top of the fuselage. Their maximum depth is 17 inches. The six spars formed of veneer sections are made up of spruce combined with plywood gussets into the form of a double Pratt truss. These spars taper with the wing from the root, or fuselage end, to the tip, so that the wing curve is kept constant throughout, and yet all spars are straight members.

The spars weigh only 10½ pounds each. The combination of the ribs and plywood in the form of the wing curve fore and aft reinforces the spar enormously, in forming the whole wing into a sort of reinforced tube which practically gives double the strength of the spars alone. Additional wing compression members are added on top at the points where the maximum stresses occur. All drift is taken by the veneer covering itself, the factor of safety in this direction running into the hundreds.

The control surfaces are built in the same manner as the wings, with tapered spars of wood and veneer glued on the outside. The stabilizer area at the rear is adjustable while in flight. The rudder is a continuation of the flat sides of the fuselage at the rear, and hence has considerable action in proportion to its surface, so that by counterbalacing it, for a comparatively small effort on the part of the pilot, it has more than the usual effect, even on this fuselage, which is much shorter than on the usual aeroplane. The machine can be turned about in almost its own length while taxiing on the ground.

There are no wires or turnbuckles in the plane, nor need any adjustment be made after flight, except as relates to engine performance. All controls are push-and-pull tubing, with bell-cranks and ball joints where needed.

The seating arrangement is rather unusual, the pilot sitting forward, just to the rear of the engine. There is a wire-glass window just over the engine hood, as in automobile practice, through which the pilot gets his forward vision. On his right and left, opposite his eyes, are the wings, and looking down on either side he gets a clear vision of the ground for landing. For vision above, an overhead window is provided.

Back of the pilot and a step lower down, is the floor of the body proper, with a door on either side, as in motor car practice, these doors being close enough to the ground when the ship is at rest so that passengers can step directly from the ground into the body without using a ladder.

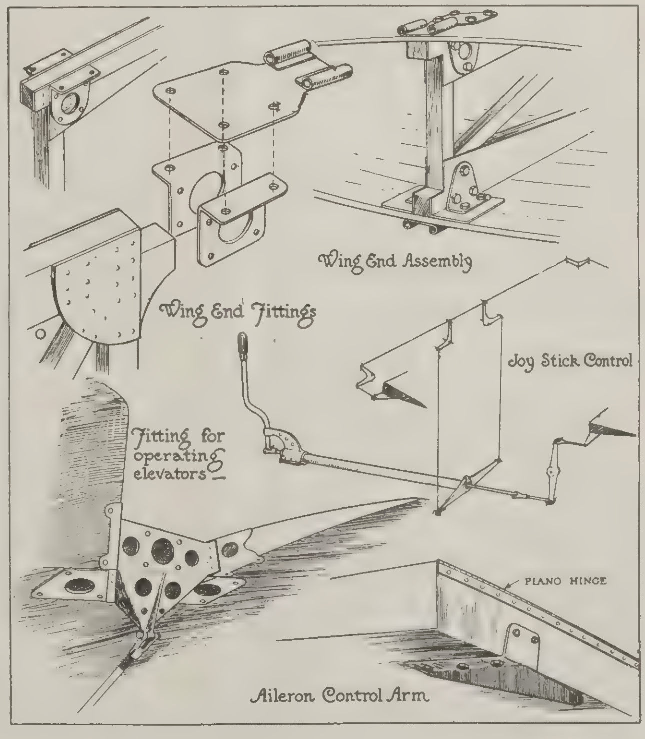
The two passengers sit side by side opposite the windows, just to the rear of these doors, thus making a three-window arrangement on each side of the fuselage, the central windows being in the doors. Just back of these windows is a round porthole for inspecting the controls and rudder at the rear end of the fuselage.

The control is by the usual joy stick; and the aileron, elevator and rudder arrangements are standard, as are also the engine controls. Added features are an electric starter button on the floor, and a primer on the dash.

The power plant is a Packard eight-cylinder engine, with many new installation features. As a fire preventative, the carburetor is located below the crankcase and the air intake into the carburetor is led completely outboard, so that any backfire from the engine will be conducted outside the fuselage.

The gasoline lines have flexible connections throughout, so that vibration will not affect them. The tanks are 12 feet away from the engine, in the wings on each side of the pilot, and the gasoline gage is directly in his line of vision. A loop is provided in the gas line so that if there is any leakage in the tank the gas will run down the pipe and drip onto the floor beside the pilot, and the leakage be detected immediately. The feed is by gravity alone, with a head of almost 5 feet.

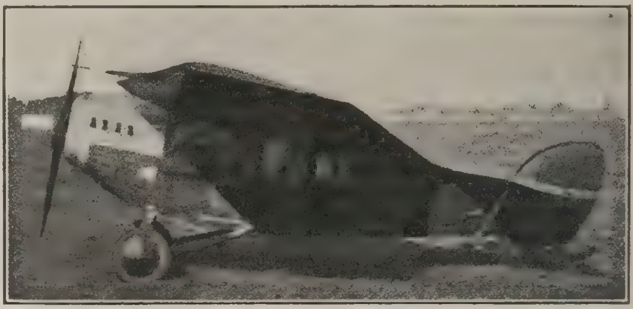
The landing gear is of more or less conventional type, but on account of the wing clearance from the ground, it has been possible to arrange for more length in the rubber bands than is possible in the usual biplanes, thus making for far greater landing safety in rough places.



The propeller is of birch wood and is made specially for this machine by the American Propeller and Manufacturing Co. It is 8 feet 6 inches in diameter and gives an air speed of 120 m.p.h. at 1700 r.p.m.

All of the fittings are ingeniously designed and are made up of cold-rolled stock, a commercial material always easily obtainable, rather than of high tensile alloys of which deliveries are sometimes uncertain.

During the war Mr. Stout was technical advisor to the Aircraft Board at Washington, and since his release from these duties has been engaged on the development of his internally trussed wing plane. The plane described in this article is the third of the series developed.



Side view of the Stout Monoplane

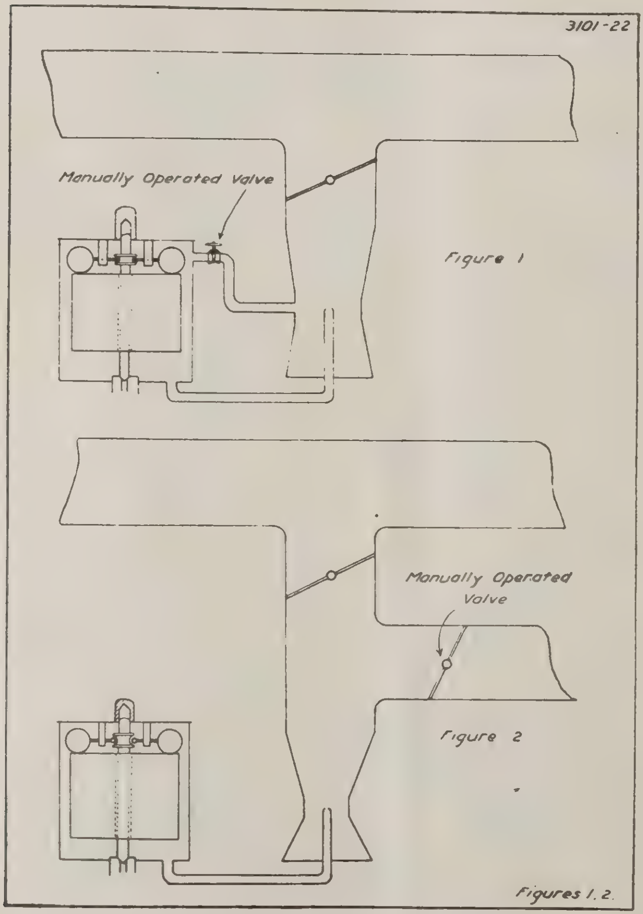
HIGH THERMAL EFFICIENCY IN AEROPLANE SERVICE

By S. W. SPARROW, Automotive Power Plant Section, Bureau of Standards

(Technical Note of the National Advisory Committee for Aeronautics)

TO make higher engine efficiencies possible without making every effort to insure the attainment of this higher efficiency in actual service can seldom be justified. In most cases the wide difference between the average performance of an engine and that in the laboratory may be attributed to the difficulty of the problem rather than to failure to appreciate its importance. Instances where this difficulty appears to have been surmounted are thus deserving of careful study.

In this regard, the details of design of certain foreign engines, whose high *average* efficiency has received much publicity, are of particular interest. In an examination of these engines at the Bureau of Standards the unusual type of air-fuel ratio control suggested itself as a possible source of the high efficiency. Fig. 2 shows this type diagrammatically, while Fig. 1 is typical of a construction common on American engines. In the latter type the rate of fuel flow is altered to produce the mixture ratio changes. This may be accomplished by restricting the fuel passage, or, as shown in the figure, by changing the head producing flow through the agency of a valve in the passage connecting the float chamber with the carburetor throat. Similar results are frequently obtained by a type similar to that shown in Fig. 2, but so proportioned that the mixture ratio change is unaccompanied by any appreciable change in the quantity of charge supplied. In contrast, Fig. 2, to typify the foreign construction, is assumed to be so designed that the leaning of the mixture is always accompanied by an increase in the amount of charge supplied. This may be effected by interconnecting the throttle with a device for altering the size of the fuel orifice or, as shown in the figure, by an auxiliary throttle which admits a very lean mixture or pure air. For this auxiliary throttle to be effective, the carburetor throat must offer a considerable restriction to air flow. The important difference between the two types is that in the one shown in Fig. 1 the change in power produced by a mixture change is due almost entirely



Figures 1. 2.

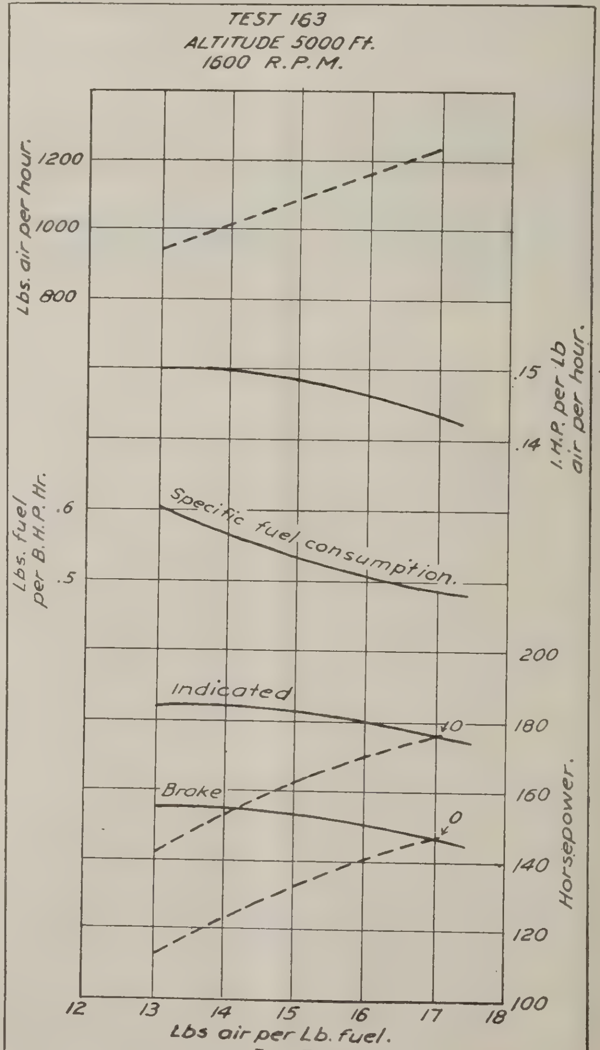


Fig. 3.

to the change in power producing ability of a unit weight of the mixture, while in the other type there is always the additional effect of the quantity change necessary to bring about the change in mixture quality.

Fig. 3 indicates something of the economy that is possible with the type shown in Fig. 1. The curves (shown in full lines) are based on tests of an 8-cylinder aviation engine at an altitude of 5,000 feet and a speed of 1,600 r.p.m. It will be noted that a decrease in the specific fuel consumption of over 15 per cent is secured when the mixture is leaned until there is a decrease of 10 horsepower in 150, i. e., 7 per cent. Unquestionably, then, so long as this type of control has sufficient range, its proper handling will result in a marked fuel saving. Will it receive such handling? To realize how unlikely this is, it must be remembered that continuing the mixture impoverishment will ultimately result in a blowback in the carburetor, a likely cause of fire. Knowing that safety depends on not reaching this condition and lacking knowledge as to how close to it a given carburetor setting is, the pilot has every incentive to adjust away from, rather than toward, maximum efficiency. Even were it possible to eliminate the fire hazard, the problem would be far from solved. In flight, the only measure of performance ordinarily available is that of power as indicated by the engine speed. In spite of all evidence as to the benefit of the lean mixture from the standpoint of efficiency, such an adjustment, inasmuch as it results in lower power, the only gauge of performance available to the pilot, is bound to be unnatural.

The explanation of the disadvantages of the first type makes clear the merits of the second. With this, as the mixture becomes of poorer quality, the amount supplied is increased. The natural adjustment, that for maximum power, will be the one at which the decrease in quality ceases to be overbalanced by the increase in quantity. If the design is such that this point is always reached before the mixture becomes lean enough to cause a blowback in the carburetor, there is a considerable safeguard against fire.

Since this type of control permits the maximum weight of charge to be supplied only when the mixture quality is such as to give a comparatively lower power output per unit weight of charge, it is obvious that the greatest engine power will be slightly less than with types which permit the maximum power producing air-fuel ratio to be obtained when the maximum weight of charge is supplied. This constitutes the chief limitation of this construction. That the marked advantages of this control appear only at full throttle can scarcely be considered a fault, as most commercial flying may be expected to take a place under these conditions. An example of the variation of power that might be expected at different mixture ratios is given by the dotted lines of Fig. 3. Suppose the point O to indicate the desired mixture ratio for operation and hence the point at which the design permits the maximum charge to be supplied. The power at the other throttle positions has been estimated from the weight of air required to give the various mixture ratios and the indicated horsepower developed per pound of air at these mixture ratios as determined from the full line curves.*

In the over-dimensioned engine, parts are designed for the stresses of full throttle operation at a certain altitude and the throttle closed so as not to exceed this power at lower altitudes. The mixture ratio control described above forms an admirable safeguard against full throttle operation at these altitudes, inasmuch as, under these conditions, it supplies a mixture too lean for engine operation. Moreover, some of the previously mentioned power loss at full throttle may be offset by an increase in compression ratio. A throttled engine can employ a higher ratio with safety than one operating at full throttle.

With a knowledge of the faults and merits of the various types of mixture ratio control, choice is dependent upon reliable information as to the service to which the plane is to be subjected. As commercial aviation develops, economy is more likely to be of paramount importance than maximum power. It is to point out one method by which high average fuel economy has been realized and to again emphasize the wide gulf separating maximum economy and maximum power adjustments that this discussion has been prepared.

* No consideration has been given to the change in fuel flow resulting from the different suctions produced at various throttle positions or to the change in the pumping loss element of the friction horsepower under these conditions. Such consideration is not needed in the general comparison here made, but is of very real importance in a detailed design of either type.

PECULIAR VISUAL PHENOMENA REVEALED BY AIRMEN

By FELIX LINKE* a German Authority

WHEN standing on the precipitous Bastian Rock on the bank of the Elbe and looking down on the river flowing below, the effect on the spectator of a downward glance over so steep a declivity is usually such as for the moment to produce the illusion of flight. As a matter of fact, the lanscape lying at the bottom of the rock, when viewed from its top, presents to the eye of the observer exactly the same appearance as it might if seen from an airship or a balloon. There are but few accessible points on the surface of the earth from which it is possible to derive such an impression, and it is for this reason that I mention the fact. Unfortunately it is impossible to assume that many readers will have the opportunity of viewing the earth from a flying machine or a balloon, while there is no doubt that many have had, and many more will still have, an opportunity to enjoy the view from "an exceeding high mountain."

It is by no means immaterial from which point of view a landscape is seen, whether from the top of a gradually ascending hill or from a point which practically affords a bird's-eye view all at the same level, the impression received being quite different in each case. And this leads us to the consideration of another interesting point, which is becoming of ever-increasing importance under the circumstances in which we live today.

What Airmen Can See

The statement has frequently been made by thoroughly scientific airmen that it is possible from an airship or a ballon to see right down to the bottom of the ocean provided, of course, it is not situated at too great a depth below the surface of the water, to recognize its configuration, and to see distinctly objects suspended in the water or lying on the sea bottom. Such airmen have also stated that they were able clearly to distinguish the formation of the sand waves on the sea bottom, the impression conveyed on viewing such tracts of water from the balloon or the airship resembling that of very flat, shallow land, temporarily submerged under water. All the experience gained in the present war has tended to confirm the correctness of these observations.

All this is the more remarkable when it is borne in mind how little can be seen from the deck of a vessel, and that it is possible to see even to a comparatively short distance into the water only when the weather is perfectly clear and bright and the sea quite calm. From a bird's-eye view, on the other hand, a grand view may be obtained even when the sea is by no means calm, fairly high waves being necessary in order that this view into the deep may be interfered with. Of course, the question at once arises to what this difference may be due, as at first glance it must appear that it could not possibly make a difference whether one looked down upon the water from a height of several meters or from that of several hundred or thousand meters, the most obvious conclusion being, at first thought, that if there is any difference at all, we should be able to see better at close range than at a greater distance, and especially that the reduction of distance should enable us to distinguish details with greater accuracy.

Affecting Circumstances

As, however, the facts of the case cannot be made to conform to this theory, it may justifiably be assumed that matters are not so simple, and that the result is affected by circumstances which do not appear on the surface. Such circumstances may be due to various causes. In certain states of weather, for instance, the observer in a submarine places a yellow disc in front of his instrument before making his observations. Under the conditions then prevailing he is able to see much better with, than without, the yellow disc, although the sole object of that disc is the absorption of rays of light, and one is consequently inclined to assume that its presence would make it more difficult to see clearly. In this case the solution of the problem is quite easy, the object of the yellow disc being the absorption of rays of light, the presence of which would exercise an injurious influence on vision and the absence of which renders the visible picture clearer and more distinct.

But the phenomenon we are considering is due to different causes. In our case, the view is taken—external conditions being the same and no optical instruments whatever being employed—in the one instance from the deck of a vessel a few meters above the level of the water and in the other from a flying machine at a height of several thousand meters.

The explanation of the phenomena with which we are now concerned has been discovered a short time ago by Professor Richarz, of Marburg, who has shown that the accuracy and clearness with which the images of objects situated under water can be viewed increase with the increase of the distance between the observer and the water level.

It is, of course, obvious that a pencil of rays starting from an object situated under water and viewed from a very great distance above the sea level must be very long and narrow, and that it can consequently cut the surface of the water only in an extremely small circle.

For all practical purposes it may consequently be assumed that the right by which the image on the retina of the eye is formed virtually converge to a point thereon, and it consequently follows that, in the event of the surface of the water becoming covered with waves or ripples, the small circle in which the pencil of rays cuts the surface will move to and fro as a small disc, but that it will, nevertheless, virtually remain smooth and flat on account of its small dimensions. The rays will consequently not be broken up, but will remain parallel, and the image to which they give rise will remain clear and distinct.

Quite different conditions prevail when looking down on a submerged object from a height of a few meters. The pencil of rays will constantly become broader and will cut the surface of the water in a comparatively large circle. When now the water begins to ripple, either on account of the undulatory movement of the waves or under the action of the wind, the circle between the two limiting rays of the

(*Continued on page* 445)

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EXPERIENCE WITH GEARED PROPELLER DRIVES FOR AVIATION ENGINES

By K. KUTZBACH

Translated from Technische Berichte, Vol. III, Sec. 3, by Starr Truscott, Aeronautic Engineer, Bureau of Construction and Repair, U. S. N.

I. THE DEVELOPMENT OF THE GEAR WHEELS

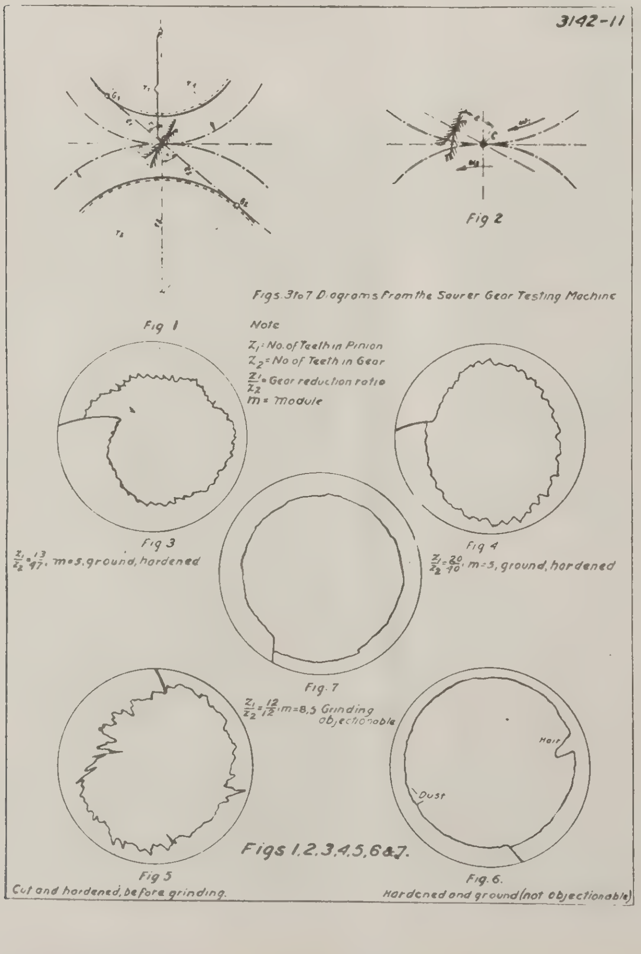
(a) *Bending Stresses.*

The greatest stress in the gear tooth is determined by the value of $\frac{P_{max}}{b.t}$. If one assumes—as is common with straight cut spur gears—that the greatest tooth pressure (peripheral pressures) encountered, P_{max}, is distributed uniformly over the whole width b, but is carried only by the outer corner of one tooth, then for gear wheels with teeth of the common involute form

$$K_b \sim 14.\frac{P_{max}}{b.t} \qquad (1)$$

From the power N delivered by the engine to the gear there can be determined of course only the mean value $\frac{P_u}{b.t}$, in which $P_u = \frac{75.N}{V_u}$, and this value has been computed for the various captured engines which were studied, Table I. P_{max} can, under certain circumstances, be considerably greater than P_u, either because of acceleration pressures resulting from incorrect pitch or form of teeth, or because of irregular delivery of power from the engine, or finally because of reinforced vibration near a resonance period of the shaft; consequently, no statements can be made as to the actual magnitudes of P_{max}. Accordingly, in Table I, there are considered only the mean tooth pressures (peripheral pressures) P_u, computed from the engine powers.

From Table I it can be concluded that with good steel one can at once assume $\frac{P_u}{bt} = 200$, although this value according to formula (1) represents a stress $K_b = 2800$ kg/cm². With somewhat more accurate pitching the load is carried by more than the one tooth, because of the deformation of the loaded tooth. The theoretical stress in the teeth would be less still if the root and tip of the tooth were not made so high as, for instance, in the Napier gear (in which to be sure the overlapping in meshing is reduced), or if the root were made specially thick (as, for instance, by the Maag, Friedrichshafen). This becomes especially true with the use of oblique teeth (as in the Hispano-Suiza), to which class belong herring-bone gears and arc-shaped gears, since in these the tooth pressure is distributed uniformly on an oblique line running from the root to the tip of the tooth. The stresses are worse, however, if the teeth bear unevenly as a result, for instance, of warping in hardening, untrue keying or poor forming. Too small a radius of the root is a more common defect, and on account of the scoring action is very dangerous. All these circumstances must be considered in determining the bending stress or the value of $\frac{P_u}{bt}$.


3142-11
Fig 1
Fig 2
Figs. 3 to 7 Diagrams from the Saurer Gear Testing Machine
Note
Z1: No. of Teeth in Pinion
Z2 = No of Teeth in Gear
Z1/Z2 = Gear reduction ratio
m = Module
Fig 3
Z1/Z2 = 13/47, m = 5, ground, hardened
Fig 4
Z1/Z2 = 20/40, m = 5, ground, hardened
Fig. 7
Z1/Z2 = 12/12, m = 8.5 Grinding objectionable
Hair
Dust
Fig 5
Cut and hardened, before grinding.
Fig. 6.
Hardened and ground (not objectionable)

Figs 1,2,3,4,5,6&7.

It was determined that chrome nickel steel was the material used in most of the gear wheels of the captured engines. The gears are hardened (case hardened) as a rule but are not all ground.

(b) *Compressive Stresses.*

In general, tooth failures rarely appear in the captured engines and in those instances where they have been found they might have occurred in landing. However, sufficient bending strength can be easily obtained even with straight cut gears.

The compressive strength, which might be called the *bearing* strength, seems more important; that is, the surface pressure of the opposing curved tooth faces must never exceed the elastic limit if no permanent deformation and consequently no wear of the teeth is to occur. The compressive strength also has a direct effect on the preservation of the lubricating film between the teeth, for the greater the surface pressure and the smaller the relative velocity of sliding V_g of the teeth the more difficult to keep the oil between the teeth. The relative sliding speed of straight toothed gears is zero at the pitch or rolling circle, where pure rolling of the teeth on one another occurs. At this point the oil is easily squeezed out; metallic contact between the surfaces of the teeth occurs and if the elastic limit is exceeded distortion or wear is unavoidable.

In order to compare the bearing strength of straight cut gears with the results of experience with bearings one can compute the relative tooth curvature of the teeth at the rolling circle. For involute teeth the radii of curvature of the teeth at the rolling circle are the distances e_1 and e_2 between the central point C and the tangent points G_1 and G_2 of the tangents to the base circles (see Fig. 1). The relative curvature of the teeth accordingly expresses the curvature of a roller lying on a plane and whose diameter δ_r is given by the equation:

$$\frac{2}{\delta_r} = \frac{1}{e_1} \pm \frac{1}{e_2} = \frac{1}{r_1\cos\alpha} \pm \frac{1}{r_2\cos\alpha}$$

The + sign applies if the centers are on opposite sides of the axis (external or spur gears with involute system); the — sign if they are on the same side (internal gears). The values of $\frac{P_{max}}{b.\delta_r}$ then are a measure of the "bearing strength." The values of the roller diameters δ_r for the captured engine gears are given in Table I, and since P_{max} is unknown, the values of $\frac{P_u}{b.\delta_r}$ are given.

From experience with the gears it is concluded that if all the gears are of hardened steel, $\frac{P_u}{b.\delta_r} \overset{=}{<} 100$ should be suitable, and that if $\frac{P_u}{b.\delta_r} \overset{=}{<} 30$ the gears need not be hardened. It is especially notable what favorable roller diameters are obtained with internal gears, with which hardening is as a rule unneces-

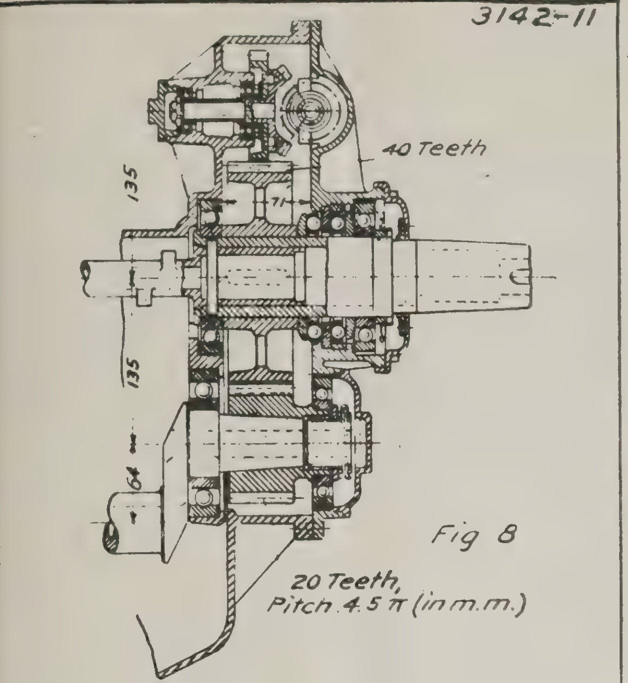


Fig 8

Gear drive of a 130 H.P. Renault Engine built by de Dion & Bouton.

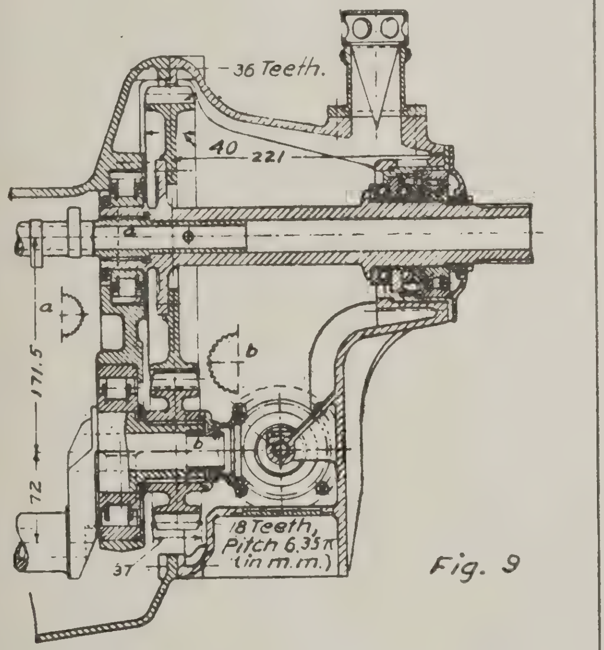


Fig. 9

Gear from a 150 H.P. R.A.F. Engine built by the British Daimler Co.

Fig. 8 & 9

sary. For roller bearings where hardened rolls run between hardened rings $\frac{P_u}{b.\delta_r} = 200$ and more is permissible for low peripheral speeds. Where the rolls bear directly on the unhardened shaft 10 to 20 should be substituted.

With oblique toothed gears the contact shifts with great speed from side to side (with Herringbone and arced tooth gears from the center out and inversely, respectively) as a result of which the lubricating film is squeezed out with more difficulty. A small angle to the teeth is of advantage in this connection.

As to tooth forms, involute teeth are found in all the captured engines, which have the great advantage of being accurately formed and independent of center distances, although the cycloidal type would have better fitting teeth and consequently smaller values of $\frac{P_u}{b.\delta_r}$.

(c) *Heating.*

When comparing gears besides the bending and crushing stresses their tendency to heat is important. The determining factors here are the heat generated—dependent on $\mu P V_g$—and the surfaces of the gear wheels which absorb and carry away the heat. In this only the width and diameter of the gears are of importance quite independently of the pitch, V_g, the momentary sliding velocity of the teeth is given by

$$V_g = e(\omega_1 \pm \omega_2) = \frac{e(n_1 \pm n_2)}{9.6},$$

in which e is the distance from the central point C (Fig. 2) at which the teeth touch and the + sign applies for external (spur) gears and the — sign for internal. The distance e varies from 0 to maximum values which are dependent on the pitch t. The mean value of V_g is consequently dependent on t and the respective revolutions n_1 and n_2 of the gears. Accordingly, the expression

$$w = \frac{P_u \cdot t(n_1 \pm n_2)}{b.d.} = \frac{P_u}{b} \cdot \frac{(n_1 \pm n_2)}{z}$$

can be taken as a measure of the heating of the gears.

(NOTE: If several gears (say i) work with one, as for instance in the Rolls-Royce drive, where i equals successively 3, 1, and 3, then this equation becomes

$$w = i \cdot \frac{P_u}{b} \cdot \frac{(n_1 \pm n_2)}{z}$$

The values are to be computed for all four gears in this manner.

In Table I this value is given for the smaller gears of each drive, since these give the higher values, and from experience with the gears it can be assumed that $w < 30{,}000$ should be suitable. The larger w is the most convenient method of cooling the gears—that is, the carrying off of the heat into metal parts and cooling these with air—must be assisted by the less certain method of oil cooling. The smaller w the less need it be feared that the gears will run hot if the lubrication is temporarily interrupted. The Rolls-Royce gear (Nos. 11 to 13, Table 1) has the smallest value of w. This is lubricated, like the bearings, from the shaft and partially by oil from without, but the oil thrown off flows back into the "dry" crankcase. In the Wolseley Hispano-Suiza gear (No. 10) a very heavy lubrication is provided by a special oil pump which squirts the oil into the point where the teeth mesh through a slit in a pipe.

The gears should not be lubricated so heavily that the oil heats up as the result of a sort of churning. This may occur either because the walls of the case are too close to the gears or because the oil is caught between the faces of wide gears and forced out sidewise with great force. In either case unnecessary friction is produced with heating and thinning of the oil and a corresponding loss of power. The more the dissipation of the heat generated can be left to the metal parts and the air the better for the gear drive and its efficiency.

(d) *Precision of Manufacture.*

The peripheral speed V_u is a quantity frequently used in comparing gear wheels. It becomes more important the more defects there are in the transmission ratio due to inaccuracies in pitch or tooth forms. Inaccuracies in the teeth can be very plainly recognized with the Saurer gear-testing machine. By courtesy of the Zahnradfabrik Friedrichshafen (Friedrichshafen gear factory) several diagrams from this machine are reproduced in Figs. 3 to 7.

(The Saurer gear-testing machine tests gear wheels of any ratio. Two accurately circular pulleys, which are connected by a steel belt, provide an exact transmission without play or blacklash with which the actual transmission of the gear wheels is compared. If the toothing is free from inaccuracies the pointer of the machine draws a circle or, if the pulleys have not the precise ratio of the gears, a spiral. The radial variations from the spiral correspond to tangential variations of the center distances magnified two hundred times, and therefore show the angular error.)

The diagrams bring out in a striking manner the defects of the transmission which may be caused either by inaccurate setting of the gear wheels in manufacture or erection, or by inaccuracies in the dividing plate or gear-cutting machine, but especially by shrinking when hardening. Besides these there occur in the gear drive itself errors due to bending of the shafts or shifting of the unequally heated gear wheels. Defects in the transmission ratio cause movements back and forth of the teeth, the blows from which are divided between both gears in proportion to the frictional and inertia resistance. Besides these there also occur reciprocal displacements of the gear centers as a result either of play in the bearings or springing of the shafts. An error of .01 mm. at the periphery would correspond to a center displacement four times as great or 0.04 mm. If the mass of one gear is very great compared to that of the other it will run on uniformly and the smaller will take all the variations. This applies, for instance, to propeller shafts whose revolving masses far exceed those of the crankshaft.

The magnitude of the acceleration pressures which arise in this case can be comprehended if one considers the time in which the motion takes place. All the motions can be considered as portions of harmonic vibrations and thus made more convenient for computation as the computation of the acceleration pressures for these is very simple.

Assume, for instance, that a tooth movement is part of a harmonic vibration whose period is the 1/ith part of a revolution. The whole vibration then has a period of $T = \frac{60}{n_1 . i}$ sec. and the greatest acceleration pressure is $P = m_{r1} . a_1 . \omega_1^2$ in which m_{r1} is the mass rigidly attached to the teeth of gear I referred to the rolling circle, a_1 (in meters) is the radius of the vibration or the distance by which gear I departed from mean position, and

$$\omega_1 = \frac{2\pi}{T} = \frac{n_1 . i}{9.6}$$

is the angular velocity of the harmonic vibration. Expressing a_1 in mm.

$$\pm P = m_{r1} \frac{(\pm a_1)\text{mm}}{1000} = \left(\frac{n_1 . i}{9.6}\right)^2 \sim G_{r1} . a_1^{\text{mm}} . \left(\frac{n_1 i}{9.6}\right)^2$$

If now, for example, $G_{r1} = 5$ kg., $a_1 = 0.05$ mm., $n = 1800$ r.p.m., $z = 20$, then $\pm P = \pm 400$ kg.

Consequently, coarse inaccuracies of tooth form or pitch can excite forces of considerable importance which are superposed on the forces transmitted from the engine. If in the preceding example the mean peripheral pressure is only occasionally $P_u < 400$ kg., changes in direction of pressure occur in the teeth and the gears will be dashed to and fro. For this reason small gears and high peripheral pressures are generally desirable. As for the rest, it is easily seen what relation the acceleration pressures have to $G_r . a$, n and i. The practical method for reducing these added pressures is indicated, however, since n and i can generally be changed less easily.

1. Reduce the referred weight Gr of both gears, or at least of one. The masses revolving with the gear teeth should be kept as small as possible, either by lightening the gears or by separating the teeth or the wheel from the other shaft by a flexible mounting. It will be explained later to what extent the flexible mounting may work unfavorably.

2. Reduce the inaccuracies a. As far as they arise from the pitching or the tools they are smaller, the smaller the diameter and the finer the pitch (or Modulus). But with fine pitches i is easily increased. On the other hand, the balancing effect of the lubricating oil becomes greater, the smaller a is, which is favorable to fine pitches (compare the Rolls-Royce gear). The best means, however, is to increase the requirements as to accuracy of toothing and assembly by accurate measurement of defects and a reduction of the magnitude of the allowable defects. If, for instance, in the example given above, the inaccuracy, instead of being .05 mm., was only .005 mm., which can easily be obtained by grinding, then $\pm P = \pm 40$ kg., which is quite permissible for the gears in question.

The diagram of the Saurer gear testing machine shows that

TABLE I. GEARS FROM CAPTURED ENGINES.

No.	Engines	N_e HP	$\frac{n_k}{n_g}$	$\frac{z_1}{z_2}$	$\frac{d_1 \text{ cm}}{d_2 \text{ cm}}$	b cm	tmm=m.π	v_u m/sk	P_u kg	$\frac{P_u}{b}$ kg/cm²	$\frac{P_u}{b . t}$ kg/cm²	$\frac{P_u}{b}$ $n_1—n_2$ $=z_1$	δ_r cm	$k = \frac{P_u}{b . \delta_r}$ kg/cm²	Remarks
1	Renault (air-cooled), 8-cyl.	70	$\frac{1650}{825}$	$\frac{16}{32}$	$\frac{80}{160}$	3	15.7 = 5. π	6.9	760	254	162	39300	1.36	187	Ratio 1 : 2
2	Renault (air-cooled), 8-cyl.	85	$\frac{1650}{825}$	$\frac{17}{34}$	$\frac{93.5}{187}$	3.4	17.28 =5-1/2. π	8.1	790	232	134	33800	1.63	142	
3	Renault (air-cooled), 12-cyl.	130	$\frac{1650}{825}$	$\frac{15}{30}$	$\frac{93.75}{187.5}$	4.5	19.64 =6-1/4. π	8.2	1205	268	134	44250	1.63	164	
4	Renault (de Dion-Bouton), 12-cyl.	130	$\frac{1650}{825}$	$\frac{24}{40}$	$\frac{90}{180}$	5.2	14.14 =4-1/2. π	7.8	1260	242	171	30000	1.55	156	
5	Engl. Daimler, 8-cyl.	100	$\frac{2000}{1000}$	$\frac{18}{36}$	$\frac{90}{180}$	3.3	15.7 =5. π	9.5	800	242	154	40250	1.55	156	
6	Eng. Daimler, 12-cyl.	150	$\frac{2000}{1000}$	$\frac{18}{36}$	$\frac{114.3}{228.6}$	4.0	19.95 =1/4. π	12	940	235	118	39200	1.96	120	
7	RAF–Napier 12-cyl.	250	$\frac{1800}{900}$	$\frac{24}{48}$	$\frac{122}{244}$	3.95	15.97 =5-1/12. π	11.5	1630	413	251	46600	2.05	182	
8	Hispano-Suiza	200	$\frac{2000}{1500}$	$\frac{21}{28}$	$\frac{112}{149.3}$	6	16.75 =5-1/3. π	11.75	1280	214	127.5	34000	1.65	130	Oblique teeth
9	Hispano-Suiza	200	$\frac{2000}{1171}$	$\frac{24}{41}$	$\frac{96}{164}$	6	12.57 =4. π	10.0	1492	249	198	33500	1.55	160	
10	Hispano-Suiza (Wolsley)	200	$\frac{2000}{1186}$	$\frac{35}{59}$	$\frac{140}{236}$	4.5	12.57 =4. π	14.65	1025	228	181	20750	2.26	100	
11	Rolls-Royce	200	$\frac{1700}{1002}$	$\frac{120}{45}$ $\frac{21}{39}$	$\frac{240}{90}$ $\frac{52.5}{97.5}$	2.4 4.5	6.28 =2. π 7.85 =2-1/2. π		$\frac{700}{1200}$	$\frac{97}{91}$	$\frac{155}{116}$	2800 2500 15400 20000	$\frac{3.6}{0.88}$	$\frac{27}{104}$	Large gear an internal gear, number of teeth on each gear divisible by 3
12	Rolls-Royce	260	$\frac{1600}{1024}$	$\frac{120}{45}$ $\frac{30}{45}$	$\frac{25}{95.2}$ $\frac{63.5}{95.2}$	2.5 4.5	$1'' = \frac{}{12} . \pi$		$\frac{915}{1375}$	$\frac{122}{103}$	$\frac{184}{155}$	2920 2600 8800 17600	$\frac{3.9}{0.98}$	$\frac{31}{105}$	
13	Rolls-Royce	300	$\frac{1650}{990}$	$\frac{120}{45}$ $\frac{27}{48}$	$\frac{254}{95.2}$ $\frac{57}{101.6}$	2.5 4.5	$1'' = \frac{}{12} . \pi$		$\frac{1025}{1710}$	$\frac{137}{127}$	$\frac{206}{194}$	3760 3350 13000 22000	$\frac{3.9}{0.94}$	$\frac{35}{135}$	

the accuracy of the transmission ratio can be carried very far by grinding. Accordingly, the gears should either be milled or shaped with the greatest accuracy and used unhardened with correspondingly reduced stresses or hardened and ground. In either case all gears should be tested in order that defects may be discovered in time.

The clearance (play) between the teeth may be as large as desired if, or as long as, no change in direction of pressure occurs. If, for instance, with a mean peripheral pressure of 400 kg. $P_{umax} = + 800$ kg., and we never have $P_{umin} \leqq 0$, the teeth remain always in contact. However, changes in direction of pressure occur practically, with great irregularity of torque—for instance, with engines with a small number of cylinders or low revolutions, 1—with very inaccurate toothing, but especially at periods of "critical vibration" which will be discussed later. It is satisfactory in any case if the teeth have a little play, which should be reduced only to avoid too much noise when idling and in the region of resonance. The gears of the Hispano-Suiza engines are assembled with a noticeable clearance so that after they have warmed up a sufficient oil clearance will remain.

(1) Four 4-cycle cylinders (at 180°) cause reversals in direction of pressure before the fly wheel for all speeds of revolution, and consequently, in the gear wheels without fly wheels. Six cylinders have this effect only at a low torque or with very heavy moving masses. Consequently, a 6-cylinder aeroplane engine can cause reversals either at low r.p.m. near idling speeds or at very high r.p.m. (with heavy pistons and high piston speeds). With 5, 7, 8 and more cylinders with crank angles equally spaced, the piston masses have no effect on uniformity and reversals can occur near idling speeds only for a smaller number of cylinders. Naturally, the region of reversals is largely dependent upon the compression ratio, which affects the negative work.

The reason the mass effects play a part only in four- and six-cylinder engines lies in the peripheral forces excited in the crank circle by the mass effects.

$P_u = \Sigma\,(P_m . \sin\alpha)$ in which P_u are the mass pressures of the reciprocating parts. Now $P_m = rmr . . \omega^2 (\cos\alpha + \lambda \cos 2\alpha)$. Hence $P_u = \frac{r\omega^2}{2} \Sigma\, m . (\Sigma \cos 2\alpha - \lambda . \Sigma \sin\alpha + \lambda . \Sigma \sin 3\alpha)$. For 4-cylinder engines $\Sigma \cos 2\alpha = 2$ and for 6-cylinder $\Sigma \sin 3\alpha = 3$. For all other equi-angular crank settings the respective summations $= 0$, consequently the peripheral forces excited by the masses are $P_u = 0$.

(*To be concluded*)

(*Continued from page* 441)

pencil will likewise begin to move to and fro, but, on account of its comparatively large dimensions, will not remain smooth and flat, but will become bent or distorted in a manner corresponding to the movement of the waves. That it is impossible to observe a distinct image on such a disc will be obvious to anyone who has even looked into a bad mirror. The smallest movement of the water will cause the image to disappear. And for all practical purposes it may be assumed that the slight vibrations sufficient to destroy the image are always present.

Calm Water Essential

It is consequently clear that, unless the surface of the water is absolutely calm, it considerably increases the chances of obtaining an accurate view, that the pencil of rays should be as narrow as possible, or, in other words, that the position of the observer should be situated at the greatest possible height above the sea level. It is now clear why it is possible to observe an object under water with much greater accuracy and distinctness from a balloon or a flying machine than from the deck of a vessel, when the water is in motion, while practically nothing can be observed from the latter standpoint even if the water is moved only to a very slight extent.

These considerations are, however, by no means sufficient satisfactorily to explain the various phenomena which occur. And it is just at this point that the consideration of the impression received when looking down from the Bastian Rock, referred to in the beginning of this article, becomes helpful. As we look down on the river, rushing past far below, the water appears quite black. Looking, however, further away, towards the right or left, and consequently viewing the water more obliquely, it becomes brighter and more brilliant, while, as we glance at the horizon, we see the river passing through the landscape like a jeweled ribbon. This comparison, which may appear at the first glance as somewhat too poetical, is in reality quite justifiable and will not appear too strong to anyone able to recall the impression received when looking down from a mountain or a high rock upon flowing water. In every case the impression will be that of a brilliant, silvery, glittering surface against the dark background of the earth. But when we compare our own impressions with the descriptions given of their travels by airmen we find that they always speak of the appearance of the water as dark.

The same phenomenon meets us when we consider photographs of clouds taken from a balloon, in all of which the fleeting clouds beneath the balloon appear the brighter the greater their depth below the spectator, while darkness prevails directly beneath the balloon. In the case of water the impression produced is, of course, much more vivid, as the distance of the observer from the earth is naturally much greater than from the clouds, whether he is flying in a balloon or in an airship. And now, what is the explanation of this phenomenon?

A somewhat simple experiment may assist us in solving the problem. It is carried out by the aid of a silvered mirror of rather thick glass. If now a fine, point-like source of light, or as that may be difficult to obtain, a very brilliant, brightly illuminated piece of metal is held above the mirror, we notice at once that there is produced in the mirror not, as is usually the case, a single image of it, but several images.

Photographing the Phenomenon

To enable a photo of the phenomenon to be produced, I made use of a corkscrew having a blunt edge which was illuminated with a powerful half-watt lamp of a luminosity of 2,500 candlepower. This edge was placed above the mirror and at a distance from it of not more than a millimeter. Now, when looking vertically down on this arrangement we are unable to see anything, as the images produced in the mirror are, of course, hidden by the corkscrew. In order that we may be able to see it is consequently necessary to view it somewhat obliquely, in which case a reflected image can be observed, which, however, is so dark as to present a striking contrast to the very brilliant illumination of the edge. When, however, we view the mirror and the edge more obliquely, the image seen in the mirror will become brighter, and besides the image already referred to, we shall perceive at least two additional images, while under specially favorable circumstances as many as nine images may be observed. In carrying out this experiment there can be seen, in addition to the upper image of the corkscrew itself, other images. It will be quite easy, with ordinary accessories and employing an ordinary lamp, to recognize five, six or even seven images as described.

What is the significance of the phenomenon and to what cause is the appearance of these images due? Attention must first be directed to the fact that the second reflected image is nearly as bright as the reflected edge itself, while the first is of about the same luminosity as the third. The reason for this is, of course, obvious; the different degrees of luminosity being due to the fact that the edge itself is reflected not only on the rear silvered surface of the glass, but also on its upper surface, which produces the first reflected image. This image, obviously, cannot be as bright as the second which is due to the silvered surface.

Now, the bright images all act as new luminous edges, which are again reflected at the glass surfaces, with the result that a whole series of images will be produced. They, of course, very rapidly diminish in brightness, as each additional new reflection is accompanied by a loss of light. The eye of the observer is under the impression that it perceives the reflected images vertically beneath the edge itself, as they seem to appear at the places indicated by the Roman numerals I to V.

That the images observed are in reality reflected images of the edge of the corkscrew can be proved by making a little notch in the lower portion of the edge, which will appear at the top in all the reflected images.

An Interesting Point

The most interesting point for us to observe is, however, not the repeated reflection, but the fact that the greater the inclination of the line of sight to the vertical the more distinct does the entire phenomenon become. The more obliquely the mirror is viewed, the brighter will be the appearance of the reflected image; this being due to what is known as the polarization of light. It is quite possible to check mathematically, as Richarz did, the result empirically obtained, in which case we will find that fact and theory coincide. For our purposes, however, the description of the experiment must suffice. It may be carried out on an extended scale by considering the various cases of it that occur in many well-known phenomena of nature.

As already stated, the water of a rapidly-flowing river seems to be quite dark directly below us, as we look straight down; it becomes brighter the further away towards the right or left we direct our glance; its brilliant silvery appearance being due to the light of the sun, which entirely overcomes the originally yellow color of the water. From gradually ascending hills or mountains we may obtain a view of brilliant silver surfaces of water, this being due to the fact that the elevation is always such as to compel us to view very obliquely any sheets of water existing in the surrounding landscape. On the other hand, water seen from a balloon, which flies usually at a height of a few thousand meters, or even more, always appears dark, as one is constantly looking straight down upon the earth beneath.

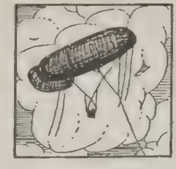
Solar "Glare"

It is consequently obvious that any landscape when viewed from a flying machine will appear quite different from the same landscape when viewed from a hill-top or the like; a fact that will at once impress itself on every observer. When looking straight down, the reflection due to the light of the sun plays no part whatever, but when we look obliquely over a landscape it predominates over everything else and gives rise to the well-known silvery reflection of the water, while it renders invisible all objects therein, whether they consist of submarines, mines or what not. From the height at which a flying observer is situated, on the other hand, everything remains visible. And as a submarine is after all not a very large object it remains visible distinctly even from a very great height.

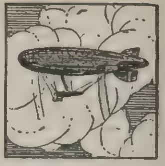
Further, as the comparatively small mines are never placed singly in the water, but are always arranged in large groups or in long lines, an aviator is always able at once to detect large mine fields and to observe their position. From the deck of a vessel, on the other hand, practically nothing of this can be seen, as even at a distance of a few meters above water level the surface will appeal silvery and deaden all rays of light which may possibly have their origin in objects lying under the water.

A good example of the truth of these remarks is supplied by a photographic picture in the possession of the writer and taken recently while traveling on a river steamer. In the vicinity of the steamer the water appears quite dark, some distance away it is brighter, it brightness gradually increasing with the increase of distance, until finally it becomes quite white, a very interesting fact being that the water appears quite dark at a spot where the presence of a bridge prevents the direct incidence of daylight.

It is thus not possible to obtain from the deck of a moving steamer either a good view in a vertical direction, especially when the water is in motion, or any view whatever worth having into the water even within a limited radius. It is, therefore, in the highest degree unlikely that an observer will ever be able to discover in time from the deck of a vessel the presence of an unknown mine field, over which the steamer may be passing, or of a submerged submarine. Such a boat will never intentionally approach a man-of-war so closely as to render discovery possible, while a warship will no longer be able to prevent itself from entering a mine field, once it has approached it closely enough to become aware of its presence, the energy stored in the moving vessel being much too great to enable even the most daring maneuvers to stop it in time, if close enough to render the mines visible.



FOREIGN TECHNICAL DIGEST



Tensile Strength of Punched Out Steel Strips

Sheet steel is used in aircraft construction to a large extent. To reduce weight, the sheets are often punched.

The article refers to experiments carried out by Dr. Ing. E. Preuss at the Technical College in Darmstadt on the distribution of stresses over the surface of the punched-out steel. It is shown that over the edge of the hole the stress may exceed the normal by over 200 per cent. Under these conditions, it is of great importance that the hole should have a sharp edge free from tears. The experiments should be extended to determine the effect of varying distance between the holes, as well as of the presence of bolts. (Karl Balaban, *Der Flug*, May, 1920. 4 cols.)

Lateral Stability

When disturbed an aeroplane will execute oscillations about its three principal axes.

Variations in the angle of yaw are usually negligible compared with variations in the angles of pitch and roll. Pitching oscillations in practice are usually heavily damped; this the author accounts for by a loss of height of the machine. Rolling oscillations, on the other hand, persist longer. The righting couple is a function of the lift. If the angle of incidence of the wings decreases toward the tips, the longitudinal stability is increased, but the roll gets worse. For wing tips working with a negative angle of incidence, this is still further accentuated, and such aeroplanes are notoriously difficult to get out of a roll. (Oskar Heimstadt, *Der Flug*, May, 1920. 6 cols., 2 diagrams.)

Rigid Airship Development

Under this heading a series of articles are appearing in which the Zeppelin and Schutte-Lanz Works each claim priority for their designs. The claims as put forward by Helferich (Schutte-Lanz) and Eckener (Zeppelin) are very sweeping, and each attacks his rival with great bitterness. (*Luftfahrt*, May and June, 1920. 8 cols., 2 photos.)

The New Way

The author holds the view that the small aeroplane is destined to popularize flying and thus become remunerative to the aeroplane constructor.

Such machines must not be small copies of existing types, but must be redesigned from the point of view of the glider. Wing profiles should be adopted from nature (albatross), and model work done in wind tunnels using a pulsating air flow. A wing form of the type of the sea gull should be studied in different altitudes, paying special attention to the elucidation of body interference. The author considers that such "natural" wings would show much greater efficiency than our present shapes, especially on account of varying interaction between body and wings. It is by this interaction that he accounts for the fact of soaring birds remaining stationary in winds of both high and low mean velocity.

Such efficient wing shapes and body construction would produce an enormous saving in power for the smaller aeroplane. A machine of only a few horsepower would be quite safe to handle even in high winds, while the low landing speeds would reduce accidents to a minimum. Our present machines, with their high wing loadings and power requirements, are developed along unsound lines. (K. Steiger-Zurich, *Flugsport*, June 9, 1920. 5 pp.)

Commercial Aviation in Germany

This article deals with the progress made in commercial aviation in Germany since the signing of the armistice and deals particularly with the cooperation given to aviation companies by the two leading shipping companies.

Already before the war the Deutsche Luftschiffahrt Aktien Gesellschaft (abbreviated Delag, from the initials) had the benefit of the booking facilities of the Hamburg-Amerika Line, who acted as agents with their air navigation department. The pre-war number of joy-riding passengers was far ahead of 14,000, and during the armistice period the now well-known commercial airship "Bodensee" was built for and handled by the same agents and owners, incorporating the war-accumulated experience resulting in increase of efficiency by decrease of size. It need not be repeated that a successful three months' daily service led to the building of the sister airship "Nordstern," but that both were forbidden continued operation by the Inter-Allied Commission of Control, as standard war-time parts were claimed to have entered into their construction.

The Zeppelin concern's post-war aeronautical efforts have, however, not been limited to airships, the national resources allowing the exploiting of new ideas in commercial metal aeroplanes. The Lindau works have added a twin-engine ten-passenger all-metal flying boat monoplane, to the design of Herr Dornier.

Another Zeppelin plant, the Staaken works branch at Berlin, that during the war produced the four-, five- and six-engined giant bombers, has turned out a four-engined, all-metal 18-passenger cantilever monoplane with the express purpose of finding out the chances of the giant aeroplane to compete with the airship. For this reason the Friedrichshafen-Staaken route has been chosen, but so far the action of the Inter-Allied Commission has prevented developments. The size of the Zeppelin - Staaken monoplane compared with contemporary British passenger carriers may be judged from the seating arrangement of three rows of six seats.

The most important event from the commercial aviation point of view has, however, been the formation of Die Deutsche Luftrederei, jointly by the Hamburg-Amerika Line and the A. E. G. engineering concern, the organization of the former and converted twin-engined biplanes of the latter being employed, though this most important German air navigation company has also a number of L. V. G. biplanes in its service. The personnel comprises, as managing director one of the earliest German military pilots, and later manager of the A. E. G. aircraft works at Hennigsdorf, Lieut. Mackenthun, and well-known erstwhile Army and Navy pilots as station masters, among them the London bombing squadron leader, Captain Keller, at Johannisthal, and Captain Bertram at the Warneminde seaplane station. (*Aeronautics,* Nov. 25, 2 pp., 2 maps.)

The Albatross L-57

This article describes the six-seater Albatross Limousine.

It is a cantilever monoplane, with the pilot and engineer placed in front of the wing, and the passengers housed in a cabin under the wing.

Thus the general arrangement follows that of the Fokker. In detail, however, marked departures are found. Thus the front cockpit is placed much higher in relation to the wing, and the top covering of the fuselage is swept up higher. As a matter of fact, the Albatross "L-57" has its driver's seat placed not unlike that of the new "K" type 'buses, i.e., partly over the engine. The seats in this cockpit are tilted back, and the occupants sit with their legs quite horizontal. This position, which at first sight might appear to be very uncomfortable, is, as a matter of fact, quite the reverse, as anyone can easily demonstrate for himself by sitting American fashion, with his legs resting on a table top. Being thus raised to a level with the top of the propeller tip circle the pilot certainly obtains a very good view forward, and as he is on a level with the leading edge of the wing his view to the rear and upwards and downwards is also fairly good. So far, the arrangement would appear to be a considerable advance over that of the Fokker, where the wing projects forward over the pilot's head, shutting off his view upwards, and, incidentally, causing a nasty swirling draught behind his head. In the Albatros "L-57" the fairing behind the front cockpit is tapered off and is carried up over the nose of the wing.

Weight, empty	2,280 lbs.
Useful load	1,920 lbs.
Total weight	4,200 lbs.
Duration	4 hours
Weight of petrol and oil	383 lbs.
Speed, ground level	92 m.p.h.
Speed at 3,300 ft.	91 m.p.h.
Speed at 6,600 ft.	89 m.p.h.
Ceiling	11,400 ft.
Climb to 3,300 ft.	10.3 mins.
Climb to 6,600 ft.	26.5 mins.
Climb to 9,900 ft.	67.6 mins.

(*Flight*, Dec. 5.)

Night Flying

This paper was presented by Major Cecil Baker before the Royal Aeronautical Society in London and after dealing historically with the early attempts of night flying he discusses night flying training, finding the way at night, landing at night, the suitable types of machines flying in bright moonlight, in half moonlight, and dark starlight night.

He also describes various parachute flares and the effect on reconnaissance machines of enemy search-lights.

Major Baker concludes his paper with an argument in favor of a specially designed fast two-seater single-engined machine for night flying. (*Aeronautical Journal,* 16 pp.—December.)

The 300 Horse Power Ansaldo Limousine

This article describes the 300 h.p. Ansaldo six-seater biplane. The machine has a span of 13.65 meters, length 9.65 meters, height 3,255 meters and has a total weight of 1,900 kilograms. (*Flugsport,* December 8, 2 pp., 2 photographs.

NAVAL and MILITARY AERONAUTICS

Promotions in the Air Service

The following list of promotions to the grade of major was announced by the War Department on November 24: Captains promoted to major as of July 1, 1920, W. A. Robertson, J. H. Jouett, H. Abbey, Jr., M. Kirby, T. G. Lamphier, B. G. Weir, S. H. Wheeler, R. Royce, C. Spatz, J. T. McNarney, H. B. S. Burwell and C. W. Howard.

Regulations Governing Parachute Jumps

A superseding order on the subject of parachute jumps has been issued by the Chief of Army Air Service, prohibiting jumps except by those who volunteer and at less than 1,500 feet, except in case of emergency. Such jumps can be made only by qualified personnel and with the approval of the commanding officer in each individual case, and in each practice jump officers or enlisted men will be required to wear two parachutes and harnesses complete, one of which must be of the free type and manually operated.

Commanding officers furnishing equipment will be held responsible for the condition and packing of parachutes and for instruction concerning adjustment of harness and suspensions prior to a flight. When parachute jumps are to be made in the vicinity of bodies of water precautions are to be taken that a life-preserver or a kapok vest is worn by the jumper, and that motor boats are in readiness should a man be compelled to land in water.

Ross Field News

Two free balloons from the field made a series of flights December 3rd. The larger, a 20,000 cubic foot balloon, left the field at 8:00 a. m., carrying Lieut. Clarence H. Welch, A. S., as pilot and Cadets Guy W. Brown, Lloyd L. Berger and Kenneth L. Frazier as passengers. It made six flights of approximately an hour's duration each, traveling in a general easterly direction. On the last three flights but the passengers were carried, Cadets Kenneth L. Frazier and Renald L. Short, Lieut. Welch piloting. The final landing was made near Long Beach, Calif., at 2:45 p. m., after covering a distance of about 55 miles. The other balloon, of 12,000 cubic feet capacity, made three solo flights of an hour's duration each. The first was made by Cadet John B. Strider, the second by Cadet William J. McCracken and the last by Lieut. Clarence P. Kane, A. S. A final landing was made at El Monte, California, at 12:22 p. m. These solo flights qualified each of the three men for pilots' licenses. Both baloons and crews returned to the field in the evening.

Doctor Ford A. Carpenter, instructor in meteorology at the southern branch of the University of California, and head of the department of meteorology and aeronautics of the Los Angeles chamber of commerce, spoke at that Post Service Club, December 1st, on the military value of meteorology.

Plans are being drawn up for a temporary hangar for the Goodyear Pony Blimp recently received at this field. The hangar should be ready within the next few weeks and the blimp will be put in commission as soon afterward as possible.

Capt. Raymond S. Bamberger, retired, present executive officer of Ross Field, has been commissioned a major, air service, and will probably be assigned to the balloon school at Omaha, Nebraska, as commanding officer.

Capt. Thomas A. Grant, A. E. M. A., post quartermaster, was discharged November 30th and placed on the retired list.

First Lieut. Lawrence A. Lawson of this post has been assigned to the balloon detachment, Hawaiian territory and will sail from San Francisco December 6, 1920, on the Madawaska.

Hjalmar B. Hovde, formerly first lieutenant, signal corps, and meteorological officer at this post, has been re-commissioned a first lieutenant, signal corps, and assigned to the balloon school at Lee Hall, Virginia, as meteorological officer.

A new surgeon has taken charge of the post hospital within the last week, Capt. Daniel B. Williams, M. C. He was transferred to this post from Fitzirmon general hospital, Denver, Colorado. Capt. Williams has been in the army service since the spring of 1917 and served overseas one year.

General Mitchell—Author

Brig.-Gen. William Mitchell has contributed three interesting articles to the *Review of Reviews* on the Army's Air Service, the use of aircraft in naval warfare and the Air Mail Service.

NC Seaplanes for Fleet Operations

Five of the large NC seaplanes have been assigned to operate with the U. S. Navy fleets, three on the Atlantic and three on the Pacific. These seaplanes, carrying crew of five men each, will be employed on scouting problems and long distance work, for which they are well adapted, being fitted for navigation on the surface and with the radio direction compass. The definite program for their employment is being worked out by the Fleet Air Detachment commanders, Capt. George W. Steele, Jr., U. S. N., of the U. S. Atlantic Fleet, and Capt. H. C. Mustin, U. S. N., of the Pacific Fleet. The NC seaplanes will have destroyer tenders for these operations. This is the first time NC seaplanes have been used.

Personal Pars

Russell F. Dedrick formerly Lieutenant Air Service, is now located at Dalton, Neb.

Burton A. Gallup, formerly Lieutenant Air Service, and a charter member of the Association, is with A. T. Gallup, Inc., Holyoke, Mass.

A. J. P. Gallagher, formerly Lieutenant Air Service, is secretary of F. A. Poth & Sons, Inc., Philadelphia, Pa.

Major Elmer Haslett, D. S. C., formerly Air Service, has taken a position as director of the Wells Fargo Express, Mexico City.

Harry James Kennedy, formerly Lieutenant, Air Service, of the staff of Maj.-Gen. William L. Kenly when he was Director of Military Aeronautics, was married on September 25th to Miss Ruth Blanche Stewart at Rochester, Minn. Miss Stewart was formerly in the Air Service in the office of Brig.-Gen. William Mitchell. Lieutenant and Mrs. Kennedy are living at Tampico, Mexico.

Captain William Ord Ryan, class of 1914, U. S. M. A., has resigned from the Air Service and accepted a position with Halsey, Stuart & Co., Inc., investment bankers, 49 Wall Street, New York City.

Tom Poe, former Lieutenant, Air Service, is practicing law at 627 Southern Trust Building, Little Rock, Ark. Lieutenant Poe, when in the service, was editor of *The Kelly Field Eagle,* the best service newspaper published in this country.

Teaching Balloon Cadets

To avoid the employment of a costly observation or kite balloon, poles are being used at one Army field for instructing cadets of the Military Balloon Service in the rigging of their craft. Six poles are employed, from the tops of these are suspended horizontal strips which represent the belly bands of the balloon, and from these are hung the cords of the rigging. These cords the cadets learn to knot and arrange in their daily lessons.

300 Planes for Army

Bids for 300 new aeroplanes will be called for by the War Department before January 1. The planes are to be on the designs worked out by the aviation section of the army, and will include all the latest improvements which its tests have demonstrated to be valuable.

The amount to be spent on the planes is in excess of $6,000,000, that being the minimum provided in the present army appropriation bill to be used for this purpose. The total appropriation for the Air Service—exclusive of pay and maintenance of men, which is carried in other sections of the army bill—was $33,000,000, of which it was provided that not less than $5,250,000 should be spent for experimental and research work and not less than $6,000,000 for new machines and equipment.

The Air Service last year asked for $80,000,000 and will ask the present session of Congress for $60,000,000.

Pacific Aero Club Campaign

The Pacific Aero Club is conducting a membership drive to get more people interested in aviation. It has waived the twenty-dollar initiation fee and is taking in members by allowing them to pay three months in advance. It invites anyone interested in aviation to become a member.

FOREIGN NEWS

F.A.I. Aviation Records

The following records have been taken from the *Bulletin* of the Fédération Aéronautique Nationale, just to hand:—

Height

Before the war the record for height was held by Lagagneux, with 6,120 m., December 28, 1913. Since then the following results have been registered:—

Pilot	*Country*	*Date*	*Height*	*Machine*
Audemars	France	Sept. 8/15	6,540 m.	....
Poulet	France	May 20/16	6,700 m.	....
Guido Guidi	Italy	Nov. 7/16	7,675 m.	....
Bougeois	France	Sept. 22/18	7,700 m.	....
Maj. Schroeder	America	Sept. 18/18	8,810 m.	....

In 1919

Pilot Alone

Pilot	*Country*	*Date*	*Height*	*Machine*
Capt. Lang	England (Martlesham Heath)	Jan. 2	9,500 m.	D.H.9
Jean Casale	Issy-les-Moulineaux	June 14	9,520 m.	Nieuport
Rohlfs	Garden City	Sept. 18	9,577 m.	Curtiss Wasp Triplane.

Pilot and One Passenger

The record belonged, before the war, to the Austrian, Lieutenant Baer, who attained a height of 6,170 m., June 7, 1914.

In 1919

Pilot	*Country*	*Date*	*Height*	*Machine*
Lieut. Walbaum	Issy-les-Moulineaux	Aug. 3	7,570 m.	....
Lieut. Walbaum	Issy-les-Moulineaux	Aug. 8	7,800 m.	Bréguet
Lieut. Weiss	Villacoublay	Aug. 13	9,000 m.	Bréguet Triplane
Maj. Schroeder	Dayton (Ohio)	Sept. 6	8,616 m.	....
Maj. Schroeder	Dayton (Ohio)	Oct. 1	9,699 m.	Lepère

Pilot and Two Passengers

Pilot	*Country*	*Date*	*Height*	*Machine*
Lieut. Roget	Villacoublay	Dec. 20	5,890 m.	....
Jean Casale	Villacoublay	Dec. 24	6,700 m.	....

Pilot and Four Passengers

Lieut. Boussoutrot	Toussus-le-Noble	April 1	6,290 m.	Farman - Goliath with 5 persons and useful weight of 8 others represented by ballast beat the record of Porree, 4,200, in 1916
Lieut. Boussoutrot	Toussus-le-Noble	April 3	5,990 m.	13 passengers
Lieut. Boussoutrot	Toussus-le-Noble	May 5	4,860 m.	24 passengers

Speed

The record on a kilometre gained under the conditions laid down by the rules of the F. A. I. belongs to Sadi-Lecointe, with a speed of 275 k. 862 per hour:

Pilot	*Country*	*Date*	*Speed*	*Machine*
Sadi-Lecointe	....		275 k. 862 per hour	....
Sadi-Lecointe	Villacoublay	Dec. 15	307 k. 555 per hour	Nieuport
Bernard de Romanet	....	Oct. 22/19	268 k. 631 per hour	

Duration

The English non-rigid airship N. S.-11 was in the air 100 h. 50 m. February 9-13 at Longmoor, near Aberdeen, and covered 3,300-4,000 k. Came down for want of petrol and water.

Distance in a Straight Line

Pilot	*Country*	*Date*	*Distance*	*Machine*
Lieut. Boussoutrot	Toussus-le-Noble to Casablanca	Aug. 11	1,872 k. 870	Farman - Goliath without landing.

Loopings

Pilot	*Country*	*Date*	*Loopings*
W. T. Campbell	Texas	Jan. 19	150 consecutive loops
Maj. Maletin W. Maynard	America	Feb. ..	218 loops in 67 m.
Fronval	Madrid	Oct. ..	624 loops in 2 h. 45 m. 19⅕ s.
Fronval	Villacoublay	....	972 loops in 3 h. 52 m. 10 s.

Landings

On January 19, 1919, Vedrines, on a Caudron G-3, started from Issy-les-Moulineaux and landed on the roof of the Galeries Lafayette at Paris (area 20 m. by 8 m.) and gained the prize of 25,000 fr. offered in 1909 by the directors of this business to the first aviator who could land on their terrace.

Aerial Acrobatics

With regard to aeronautical acrobatics the F. A. I. insists that these must be kept in their right place. Although necessary for the complete education of the pilot they ought not, they state, to supplant the pure sport, of which they are but a deformation.

At the desire of its Aviation Commission, the Aero Club of France voted on October 19, 1919: "On principle, to punish in future the authors of acts liable to discredit aviation and to cause accidents."

With reference to the consecutive loopings shown above, M. O'Gorman suggested recently that, in the interest and for the safety of the aviator, it would be better for the F. A. I. not to make allusion in their reports to such performances as Fronval's 972 successive loopings. This was not sport, he said; it was the same kind of performance as playing the piano for eight hours without eating. It was like the work of an equilibrist and not a sport which should be encouraged, because the day might come when an aviator would kill himself when making the 973rd loop, and he would have done nothing for the advancement of aviation. M. Vleminkx and M. Surcouf disagreed entirely with M. O'Gorman. During the war, M. Surcouf stated, the belligerents had formed schools for acrobatics, and one could not compare loopings carried out round an enemy with exaggerated feats on the piano. Who could say but that loopings in the future would be carried out with such security and ease that they would become a means of preventing accidents and overcoming obstacles and difficulties? The F. A. I. would then regret having sat in judgment against a thing which they might perhaps be obliged to introduce into their rules.

The Indian Government and Aviation

The British Government have despatched to India a present of 60 D.H.9 aeroplanes and 40 Avro-Monos, and the Government of India is so appreciative of the gift that it is offering these aeroplanes gratis to anyone who will accept one and remove it from Karachi. The only condition is that the machines are not to be sold to third parties. This action is unfortunate in many ways, as it will give the impression that the Government of India, having burnt its fingers over the fiasco of the air mail from Karachi to Bombay, is not willing to dip them into petrol again, and, in fact, considers civil flying to be useless. A Calcutta correspondent of a contemporary went so far as to doubt whether the gift of the Government is worth the expenditure on the freight, and alluded to the air mail incident as a support of his views. That fiasco proved nothing except that air mails ought to be run by people who understand the business. No transport company would have selected such a route, such timings, or such machines. It is to be hoped that the machines in question will serve a good propaganda purpose, though we should have preferred to see the Indian public introduced to civil flying through the medium of post-war types, such, for example, as the Avro-Renault.

Some of these gift machines have been accepted by Local Governments, which is the best fate that could have befallen them, as they ought to prove very useful in hurrying officials—doctors, magistrates, or police—to outlying villages in cases of emergency. Others have been offered to Ruling Princes, who may use them for similar administrative purposes or for their personal pleasure. Many of the Princes would prize such a possession as an aeroplane very highly. Twenty of the Avros have been made over to the R. A. F., which is a pity, as they go out of civil flying altogether. The remainder are to be offered to Aero Clubs (if any) or to private persons such as ex-officers of the R. A. F. The latter ought to be delighted at such an offer, provided that they can overcome the difficulty of procuring trained mechanics. Perhaps some of them may seize the opportunity of forming flying clubs or even small transport companies for pleasure flying and cross-country work.

Aerial Navigation Bill Passed by French Chamber

The French Chamber has passed the Bill ratifying the Aerial Navigation Convention concluded between France and Great Britain.

New Deutsch International Challenge Cup

Madame Henry Deutsch de la Meurthe has intimated to M. Michelin, president of the Aero Club of France, that the Deutsch family will present another international challenge cup for the greatest speed achieved in an aeroplane, together with a prize of 200,000 francs.

France-Morocco Air Mail Service

According to information received from the French Post Office, the air mail service between Toulouse and Casablanca (Morocco), which the public in this country have for some time had an opportunity of using for the onward transmission of letters to Morocco, is now being carried on three times, instead of twice, a week in each direction.

German Popular Interest in Flying

So great is the interest being taken in aeronautical matters by the German public, writes the Handley Page Berlin Correspondent, that no fewer than 40 volumes have been recently published by one firm in Berlin to meet the ever-increasing demand for information and technical instruction in the art of flying. Practically every phase of aeronautical engineering is dealt with exhaustively in the collection referred to, which ranges from the building of models, "The Theory and Practice of Flying," to "Aeronautical Meteorology" and "Parachutes." The books average over 200 pages, which are profusely illustrated. Every class of flying machines is described in detail as well as the various engines in use. The price per volume is from M.7.20 to M.16 each.

Aerial Lighthouses for China

The unusual spectacle of two large lighthouse lamps fully illuminated far from the seaboard was witnessed, the *Times* states, on Monday night, Nov. 29, at the works of Chance Brothers and Co., Limited, Smethwick. These lighthouses have been made for the Chinese Imperial Maritime Customs, and one is destined for Dodd Island and the other for the Shantung promontory. The former light is to be placed 147 ft. above sea level, and will be visible from a vessel's deck at a distance of 22 miles, the intensity of the beam being 331,000 candle power. The second light will be placed 220 ft. above sea level and will have a visibility of 25 miles. A number of clever devices for unattended lights were on view by means of which the lights automatically turned on at sundown and extinguished at dawn. With the development of night flying, aerial lights are being produced for the guidance of aircraft. One apparatus shown had acetylene burners giving a 500 candle-power beam visible at a distance of nine or ten miles from an altitude of 10,000 ft. Another was a revolving light, a cluster of acetylene burners giving a maximum intensity of 2,645 candle power, visible for 19 to 20 miles from the same altitude.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

The Huntington Motorcycle Engined Monoplane

THE real problem in efficiency, as far as aeronautical engineering is concerned, is to design a machine that will fly well with low power, or, in other words, a machine having a heavy loading per H.P. This, the biggest problem, is within the reach of the amateur builder or student of moderate means.

In order to design a successful machine around a motor of low power, it is necessary to make accurate calculations and work out all details very carefully so that all exposed parts will have a minimum resistance and that the weight will be kept as low as possible consistent with safety.

The machine described was designed around a two cylinder aircooled Vee type motorcycle motor developing 12-15 H.P. at about 1,800 r.p.m., and driving a propeller of 5′ diameter x 3½′ pitch direct. Greater efficiency could be obtained, no doubt, by gearing the propeller, although this change in the motor would entail some expense on the part of the builder.

It is well known that the wings of a monoplane are more efficient than those of a biplane due to the interference of the planes in the latter type. The two points of prejudice against the monoplane type—structural weakness and poor vision for the pilot—have been satisfactorily overcome in recent designs.

Aside from being more efficient than the biplane, as far as the supporting surfaces are concerned, the monoplane can be made lighter owing to the fact that fewer parts are required, which makes this type ship inexpensive, easier to construct, and economical to operate.

There are numerous advantages in building your own ship aside from the pleasure of owning your own plane. The builder gains an accurate knowledge of practical aeronautics, he knows just what the machine can stand in flight, and can make his own repairs and keep his ship in perfect trim.

The cost of building the monoplane described, providing the work is done by the builder, should not exceed $80. This figure, of course, does not include either engine or propeller.

The resistance of an aeroplane which determines the horsepower required for propulsion, increases as the square of the velocity, or, in other words, the resistance of a ship traveling at 100 m.p.h. is nearly four times the resistance of the same ship when traveling at 50 m.p.h. For this reason it is difficult to obtain high speed without a powerful engine. But in order to fly at a comparatively low normal speed, either a large wing area is required, necessitating a bigger and usually heavier plane, or else a wing section of very high lift must be employed. The U. S. A. No. 4 section was chosen because it not only gives a good lift at the angle of best L/D (that is, 4°), but also because it makes possible a ship of ample strength and small size.

The ordinates of this wing for a 54-inch chord are given in the table below.

With a view of simplicity and ease of construction, with a minimum expense, parts difficult to make, such as metal fittings, have been eliminated wherever possible and but few small parts, such as turnbuckles, clevis pins, shackles, etc., are called for in the design.

General Dimensions

Wing span	20 ft.
Length over all	14 ft. 6 in.
Height over all	5 ft. 10 in.
Wing chord	54 in.
Wing section	U. S. A. 4
Angle of incidence	4°
Dihedral	1°

Areas

Wing area (including ailerons)	80 sq. ft.
Ailerons	11 sq. ft.
Stabilizer	5.6 sq. ft.
Elevators	6 sq. ft.
Rudder	4 sq. ft.

Weights

Machine empty	220 lbs.
Fuel and oil	30 lbs.
Pilot	150 lbs.
Useful load	180 lbs.
Total weight	400 lbs.
Percent of useful load	45%
Wing loading	5 lbs. per sq. ft.
Power loading	30 lbs. per h.p.

Performance (Computed 12 H.P.)

High speed near sea level	60 m.p.h.
Cruising speed	52 m.p.h.
Landing speed	32 m.p.h.
Range at cruising speed—5 hrs	250 miles
Initial climb	240 ft. per min.
Ceiling	7,500 ft.
Factor of safety	8

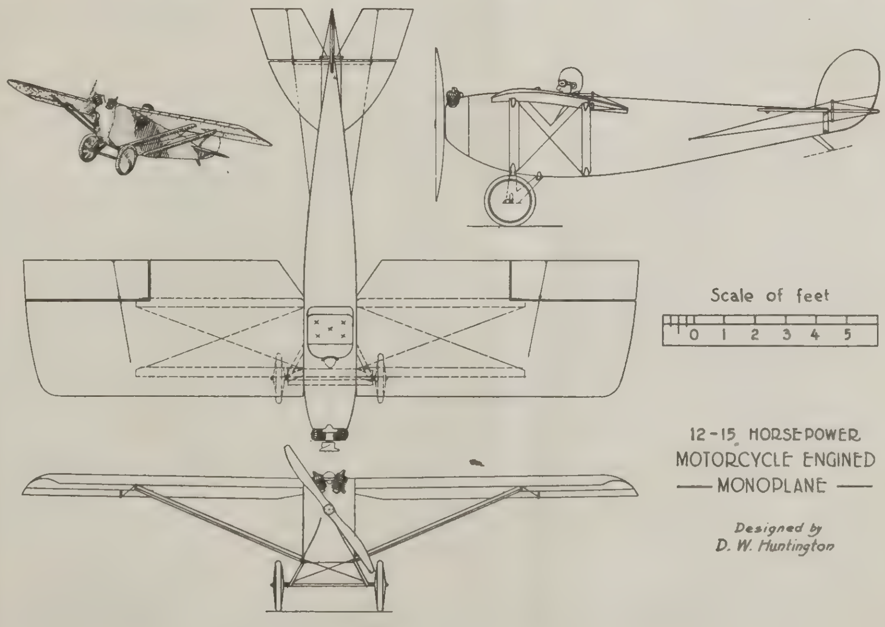
Power Plant

Type—V type motorcycle engine cylinders	2, air cooled
Power	12-15 h.p.
Weight with magneto and carbureter	85 lbs.

Full details of the construction of this little ship will be taken up in a subsequent issue of AERIAL AGE.

Ordinates of U. S. A.-4 Wing for 54″ Chord

Station location		Lower Camber from datum line (inches)	Upper Camber from datum line (inches)
Fraction of Chord	Distance from leading edge (inches)		
0	0	0	.4374
.0125	.675	.1350	1.3122
.025	1.35	.2754	1.8576
.050	2.70	.5778	2.6352
.075	4.05	.7938	3.240
.100	5.4	.9828	3.6882
.200	10.8	1.3878	4.6278
.30	16.2	1.5282	4.806
.40	21.6	1.5822	4.6278
.50	27.0	1.4202	4.2228
.60	32.4	1.0692	3.7260
.70	37.8	.6588	3.0240
.80	43.2	.3348	2.2032
.90	48.6	.1620	1.2528
1.00	54.0	0	.3834



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Flying in Five Uneasy Lessons

(By C. H. Ramsey, in the *American Legion Weekly.*)

All Yanks beat Gaul to it by one definite division. For all Yanks are divided into two parts: those who flew and those who wore regulation uniforms. For the benefit of any of the second class who are so foolish as to want to get into the first, and wish to get their papers of transfer started through the regular channels, we are offering an applied course in flight, the simplicity of which is exceeded only by its complication.

Truly has it been said that a little knowledge is a dangerous thing. The knowledge which we have the honor to set forth herewith is so diminutive as to be positively poisonous. In presenting the basic principles and fundamental precepts which are as essential to such a course as Shaffner and Marx are to Hart, particular attention has been paid to terminology. We have been careful to explain in simple language all of those things which we do not understand ourselves. The course starts with the first lesson.

Lesson I.—Equipment

All Yanks who ever saw an Army aviator walking around the District of Paris with a full make-up of a 39th degree member of the lodge, will realize that the main thing about flying is the way you dress. First, get yourself a snappy rig and then walk down Main Street and let the girls give you the once over. Do this before your first flight, as you may not make as big a hit by proceeding down the same street in a cordwood sleeping jacket and a crow-colored limousine.

However, don't be afraid. While it may look dangerous to be in a plane 20,000 feet up, still, it's a darn sight safer than being up that high and not being in one. It's safer than oratory, for the public speaker gets into a tail-spin and falls flat time after time, but the flyer never does it but once.

Get a good plane with a tail in the rear. The Wrights built their first machine with a tail in front, but as they observed that birds seldom fly in this manner they abandoned the idea, and tails are now placed in their proper position. Be sure the ship has an altimeter, ailerons and a fuselage, as you may not know what these things are and it is always interesting to find out.

Provide a supply of gasoline and oil and a mechanic. The mechanic will know what to do with the gasoline and oil. Get good clothing, as it will last a lifetime if you fly much. Then a helmet and a pair of goggles, and you are all set.

Lesson II.—Leaving the Ground

Leaving the ground is the first essential of a successful flight. Provide the ground. This should be a big, smooth field. Have the mechanic taxi the plane to the lee side of the field and head it into the wind. Then have him put blocks under the wheels so the ship can't leave without your consent. Inspect the machine. You won't learn anything from the inspection, but if any one is watching they may perhaps think that you know something. However, don't look it over too long or you will probably lose your nerve.

Now try and climb aboard without kicking any holes in the sides or wings. You will find this very similar to getting into an upper berth on a Pullman, and about as easy. Once in, you should find yourself in the pilot's seat with your feet on the rudder bar and the control stick between your knees. Wiggle the controls in a professional way and have the mechanic start the motor. This causes the propeller to look fuzzy, indicating that it is rotating. Open the throttle to see if the motor makes noise enough. It will probably make too much. Close the throttle. The mechanic removes the blocks. Push on the stick and give her the gun. You're off. Now read the following instructions very carefully:

Lesson III.—In the Air

You are now, we may hope, safely in the air. The question comes up, "What shall I do next?" This is very natural under the circumstances. Keep the machine level and flying straight. If the right wing dips, move the stick to the left; if the left wing dips, move the stick to the right; if the nose dips, pull the stick back; if the tail dips, push on the stick. It is very simple. If everything dips, try and forget about it.

To rise point the nose up slightly. To descend, point the nose higher—or lower, if you prefer. You will come down in either case.

In order to get back to where you started, it is necessary to learn to turn. To do this, kick the rudder bar either way. You are now in a tail-spin. Without losing your self-control, put the machine controls in center position and wait for the ship to stop spinning. When it does you will probably find yourself headed in a new direction. If it is not the right one, try again. Eventually you should come out right. Avoid any unnecessary turns.

Now you know how to fly straight and make turns. Practise until you become expert. If the motor stops, come down at once. Keep these points in mind and get ready for your first landing.

Lesson IV.—Landing

Landing the machine, more than any other part of flying, requires care. Remember, they never get hurt except when they land, so be sure you make a good landing. A good landing may be defined as any landing wherein the pilot gets up and walks away from the machine.

The first essential is to get near the ground. In doing this, be deliberate. Shut off the motor and descend in a gentle glide. Turn gently, so as to run into the wind as indicated by the weathercock on the wing, and gently approach the field. On arriving near the ground, gently pull back on the stick and gently hold it back until the ship sinks gently to the ground. The machine will either roll a short distance and stop or else turn over and stop.

If the attempt is successful get out, expand the chest and borrow a cigarette. If the ship has turned over, get out, make a few well-chosen remarks such as used by golfers when they don't, and then borrow the cigarette. Tradition truthfully holds that a pilot upon landing requires one of two things—medical attention or a cigarette. As you have completed your first flight, you are now a pilot. Now, one more lesson and you are through.

Lesson V.—Armchair Acrobatics

Don't be nervous about your acrobatics. They are the easiest part of the course. All you need is a good comfortable armchair, a cigar and, most important, some one who will listen to you. Shove your conscience aside and remember that a haberdasher explaining why a non-olive drab set of civvies costs a hundred units of wampum is a piker compared to the kind of liar you are going to be.

Lead them on with a bit of description of how beautiful the ground looked from the air, not mentioning that the main reason it looked so beautiful was because you wished you were standing on it. Tell them how easy it was. Tell them you weren't afraid. Tell them you didn't have any trouble at all. Tell them—anything but the truth.

Now try your acrobatics. Describe the way you looped it, illustrating the maneuvers with your right hand. Now put your right hand into a spin, coming out gracefully in a spiral. Do a few more stunts and then if you are ambitious you may bring down a Boche, represented by your left hand. Let your right hand bring down the left in flames (lighted cigar), after which it may make a short tour of the country firing a few rounds at enemy troops on the rug. The possibilities are unlimited. A good imagination is all that is required.

Here I will leave you. Probably all of your friends will do the same. You need no further instruction.

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WELCOME! THE AERIAL ERA

Review of Aviation in 1920

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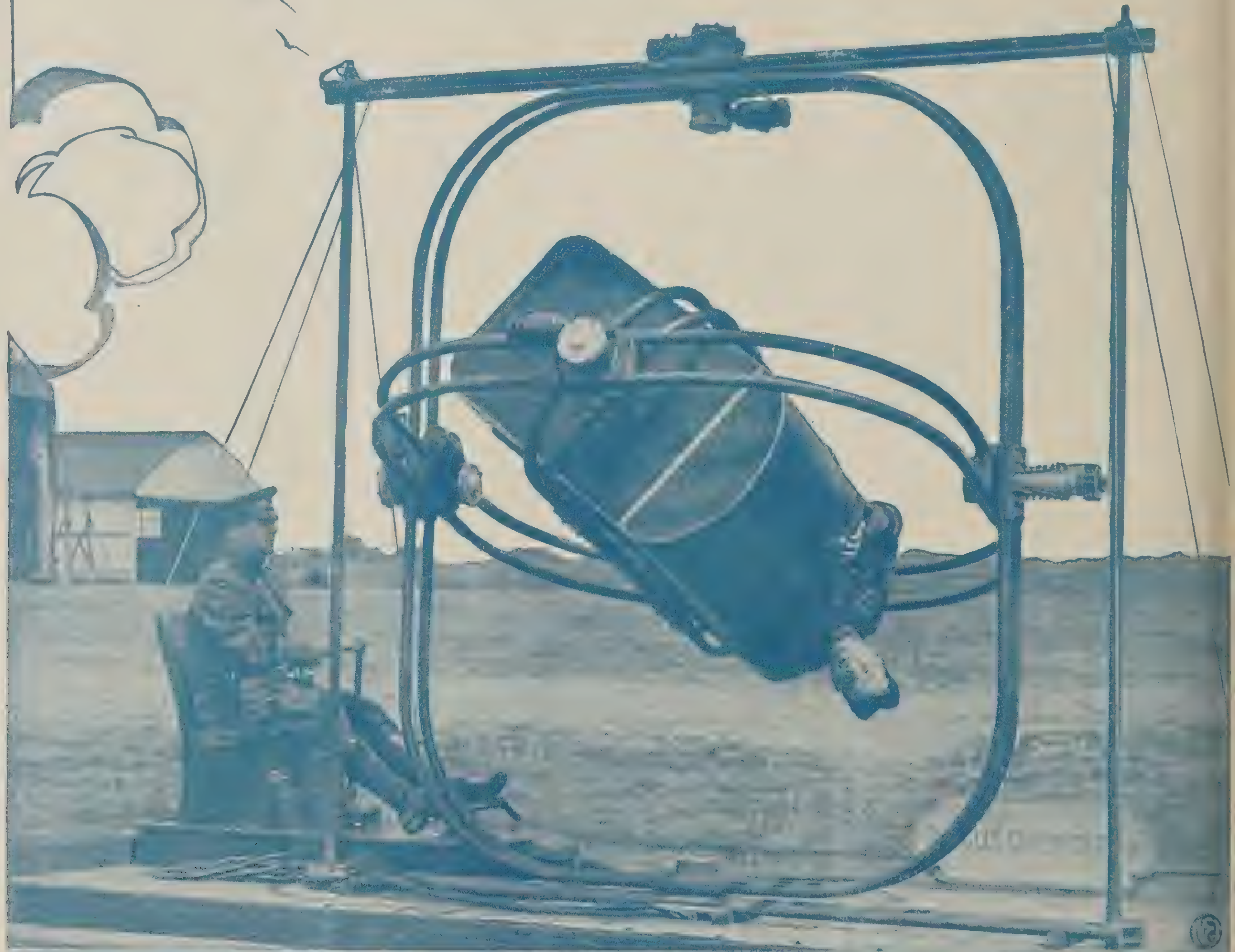

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REVIEW OF AVIATION IN 1920

THE Manufacturers Aircraft Association has prepared a comprehensive statement concerning aeronautic progress during 1920, as follows:

Despite many handicaps such as lack of aerial laws, landing fields and a strong Government policy, aircraft designed and built in America maintained a high rate of efficiency during 1920.

Decreased production and a general contraction in the aeronautical industry, generally, is offset by the more encouraging records of performance made in American aviation this year.

While the last twelve months have not brought the definitely outlined policy of federal jurisdiction required to assure steady and economical progress in commercial aerial navigation, they have witnessed remarkable achievements by American pilots flying American machines.

Commander A. C. Read, hero of the transatlantic flight in the N. C.-4, commanded the same flying boat on a noteworthy expedition from Rockaway, L. I., N. Y., down the Atlantic Coast, along the Gulf Coast and up the Mississippi River to Cairo, Ill. When the N. C.-4 returned to Rockaway, January 27th last, it had flown 7,740 nautical miles. Three of the four Packard Liberty engines had operated without trouble during the 118 hours in the air, the fourth more than 82 hours. Along the Mississippi the motors were run on commercial gasoline picked up from point to point en route. Read reported that the greatest difficulty encountered was lack of proper maps.

Compared to long flight attempts conducted by European Governments the American ventures were particularly successful. No less than four expeditions attempted to fly the 5,206 miles from Cairo to Capetown, Africa. Col. P. Van Ryndveld and Major C. J. O. Brand finally completed their flight on March 20, 1920, in a D.H.-9 plane sent up by the Government of the Union of South Africa after their Vickers-Vimy machine had crashed. They had set out from Cairo February 10th. None of the machines that started reached Capetown.

Different success attended the Alaskan Flying Expedition of the U. S. Army Air Service. Four Gallaudet remodelled D.H.-4-B planes, each powered with a single Liberty motor, and each carrying two persons, flew from Mitchel Field, L. I., N. Y., to Nome, Alaska, and return in 112 hours flying time—a total distance of 9,000 miles, without a motor missing fire or other accident serious enough to delay the party. Rain and fog caused most of the difficulty in flying over country not even charted on the maps.

The Air Mail in 1920 operating between New York and Washington, New York, Cleveland, Chicago, Omaha, Salt Lake City, and San Francisco, transported approximately one hundred million letters at ordinary postage rates. The system was extended in 1920 from Chicago to San Francisco—from Key West, Fla., to Havana, Cuba, and from Seattle, Wash., to Victoria, B. C. About 35 Air Mail planes are in the air each day flying a total, in round trips, of about 8,000 miles.

During the year the Navy has been making an aerial survey of the Panama Canal Zone.

The Geological Survey has co-operated with the Marine Corps in mapping the coastline of Haiti. American seaplanes, Curtis, Aero-marine and Boeing types, have operated on passenger routes in China.

Major R. W. Schroeder, flying an American designed and built Packard-Lepere biplane, went up from McCook Field, Dayton, Ohio, on February 26th, and reached the world's record altitude of 33,000 feet.

There were many other experimental flights made successfully. Edward Musick flew an Aeromarine flying boat off the ice at Raritan Bay, N. J., on March 13th, and carried provisions to the steamship *Princess Anne,* stranded near Rockaway, L. I. While the passengers were removed before Musick arrived his flight demonstrated that flying boats could take off and land on ice or snow and that they are invaluable for rescue work at sea.

Realizing the urgent need for laws controlling aerial navigation, several legislatures considered state legislation but the New York State Legislature after considering the subject carefully, adopted a resolution asking Congress to enact a federal law before the States passed conflicting legislation.

Practically the entire country was flown over during the year. Lieuts. H. R. Harris and A. L. Smith on March 8th flew a Martin 12-passenger Army transport plane from Dayton, O., to Washington, D. C., a distance of 385 miles, in three hours and thirty-one minutes. Major L. W. Smith on March 6th flew from Camp Lewis, Wash., to San Diego, Cal., in a Boeing D.H.-4-B plane, 1,160 miles in nine hours and forty-two minutes, most of it over mountain ranges 7,000 feet high.

On March 30th radio communication was established between a submarine and a seaplane at Anacostia, D. C. Roland Rohlfs, former holder of the world's altitude record, on April 12th flew a Curtiss "Wasp" seaplane over a measured course at Rockaway, at a speed of 138 miles an hour. Clifford Webster on April 25th flew a Curtiss H.S.-2-L flying boat with two passengers 1,345 miles from Florida to New York in eighteen hours and twenty-seven minutes. In April, Paul Wilson flew a Thomas Morse biplane from Ithaca, N. Y., to Washington, D. C., and return by way of Dayton, Ohio. An Orenco Tourister piloted by Clarence Coombs on April 30th carried four persons to a height of 17,150 feet.

The first annual intercollegiate championship airplane races were held at Mitchel Field, L. I., on May 7th, Yale, Williams and Princeton winning in the order named.

On May 27th a Dayton Wright aerial coupe reached a height of 19,710 feet with four persons.

On June 12th Donald Hudson in a Curtiss "Wasp" crossed the Andes Mountains at an altitude of 30,000 feet above sea level. On June 27th a Junker monoplane flew from Omaha, Nebr., to Lancaster, Pa., without stopping. On July 3rd Aero Limited flying boats carried a ton of grape fruit from Miami, Fla., to New York in sixteen hours. "The Bankers Special,"

(*Continued on page* 470)

THE NEWS OF THE WEEK

Plans to Fly Over Pole

Philadelphia.—Captain Robert A. Bartlett, who was master of the Roosevelt, Admiral Peary's ship on his expedition to the North Pole, has declared determination to cross the North Pole in an aeroplane.

To finance the expedition, he says, will cost about $300,000, and he is seeking to make arrangements with scientific bodies and wealthy men for the advance of this sum.

Captain Bartlett is known among army, navy and scientific men as "The Polar Bear," and is a veteran of five polar expeditions. He arrived here recently to become Port Captain in the Army Transport Service and is in charge of the transports being completed at Hog Island.

Army Flier Wins Race

Long Beach, Cal.—Flying at 146.8 miles an hour, lieutenant E. E. Bratten, army aviator, won the 100-mile free-for-all race for the Albert H. Hays Challenge Trophy, opening event of the three days' National Winter Air Tournament at Dougherty Field, December 25th. Thirteen fliers started, twelve being army men. Eleven finished.

Lieutenant Bratten's time for the 100 miles, flown over a triangular course, was 40 minutes, 52 seconds. The order in which the other leaders finished, with their time, was:

Captain L. H. Smith, 41 minutes, 37 seconds; Lieutenant Harold Brand, 42 minutes; Lieutenant Y. A. Pitts, 42 minutes, 24 seconds; Lieutenant Milo N. Clark, 42 minutes, 49 seconds.

Lieutenants A. Lee Fosster and R. M. Worthington were forced to descend because of engine trouble. The first six machines to finish were American built, equipped with 400-horsepower Liberty motors.

Chamber of Commerce Offers Camp Kearney Site to Navy Dept.

San Diego's progressive Chamber of Commerce, working for a bigger, better and busier San Diego, has obtained option on 900 to 1,000 acres of land at Camp Kearney for the proposed rigid dirigible station. This land is offered to the government at a rental of $8 per acre, with the proviso that it may be purchased within five years at $100 an acre.

Colonel Ed. Fletcher, chairman of the Chamber's committee, has obtained the necessary agreement from property owners, and the matter has been placed before the Secretary of the Navy for submission to Congress. The proposal was first submitted to the Congressional Committee investigating Navy yards and Naval sites on the West Coast. Ultimate decision, if the proposal is approved by the Navy Department, rests with Congress.

The Camp Kearney site is the most favorable in the vicinity of San Diego, according to Captain J. H. Tomb, commanding the Naval Air Station.

Another proposal has been received from the Aero Club of Southern California offering the transfer of 1,000 acres of flat land eleven miles from San Pedro, Cal., on conditions similar to those at Camp Kearney.

This proposal has not been seriously considered by the Naval authorities as yet, as it was received too late to be submitted to the Congressional Committee while here.

It is expected in event of failure of the Camp Kearney negotiations that the proposed San Pedro site will be given serious consideration.

World's Smallest Triplane

The Italian Government recently offered a prize for the smallest aeroplane which could be operated by a pilot for actual use. The machine which carried off the honors, a Macchi, is only thirteen feet wide and fifteen feet six inches long. It is said to be capable of making a speed of 106 miles an hour.

Frank Clark, Hall-Scott motor demonstrator, making a flight from the roof of a 10-story building in Los Angeles, in order to inject a thrill in Katherine MacDonald's new picture, "Stranger than Fiction"

Aero Club of Minneapolis

The Aero Club of Minneapolis is a live organization, with headquarters at 87 South Tenth Street, and field and hangars at Thirty-fourth Avenue, South, beyond Fifty-fourth Street. The officers of the club are: President, R. R. Rand, Jr.; vice-president, Wm. F. Brooks; treasurer, Harry C. Piper; secretary, Paul Goldsborough. The directors are: Paul W. Louden, H. C. Mackall, M. H. McDonald, Maurice M. Moore, Charles S. Pillsbury, Harry C. Piper, W. D. Prindle, R. R. Rand, Jr., R. G. Robertson, V. F. Rotering, Kenneth B. Salisbury, C. W. Smith, E. R. Tattersfield, Guy A. Thomas, Glenn W. Traer, Jr., S. D. Andrews, Philip J. Barnes, Wm. F. Brooks, Earle Brown, Robert Browning, F. A. Chamberlain, Joseph Chapman, James D. Craig, Matthew D. Crawford, W. W. Eastman, H. M. Gardner, Paul Goldsborough, Murray K. Guthrie, C. T. A. Hart, F. T. Heffelfinger.

Schools Teaching Aeronautics

Following is a list of colleges, universities and schools in the United States offering practical or theoretical courses in aeronautics: Brooklyn Polytechnic Institute, Brooklyn, N. Y.; Castle Girls' School, Tarrytown-on-Hudson, N. Y.; College of the City of New York, New York City; University of Colorado, Boulder, Col.; Kansas State Agricultural College, Manhattan, Kan.; Culver Military Academy, Culver, Ind.; Massachusetts Institute of Technology, Boston, Mass.; University of Michigan, Ann Arbor, Mich.; Pennsylvania State College, State College, Pa.; University of Pennsylvania, Philadelphia, Pa.; Purdue University, Pasadena, Cal.; Tufts College, Tufts, Mass.; State College of Washington, Pullman, Washington; California Institute of Technology, Pasadena, Cal.; College of Engineering, University of South Minnesota, Austin, Minn.; Worcester Polytechnic Institute, Worcester, Mass.

Course Contemplated: Georgia School of Technology, Atlanta, Ga.; University of Illinois, Champlain, Ill.; Iowa State College, Ames, Ia.; Ohio State University, Columbus, Ohio; State University of Oklahoma, Norman, Okla.; Oregon Agricultural College, Corvallis, Ore.; Sheffield Scientific School of Yale University, New Haven, Conn.

Aerial Mail Stamps

Although it is less than four years ago that the first postage stamp especially designed for aerial mail service was issued, it is estimated that, up to the present time, more than forty varieties have appeared, sufficient to make a very creditable specialized collection, and the demand for these stamps is said to be steadily increasing. While many small countries which have done very little to encourage aviation have issued adhesives for aerial postage, Great Britian has thus far refused to issue any special stamps for such use, despite the urging of many philatelic societies in the country.

The first distinct aerial mail stamp on

record was issued in May, 1917, by Italy for an experimental service between Rome and Turin. It was soon followed by another stamp for a hydroplane mail between Naples and Palermo. Two years ago the United States issued its first aeroplane stamp for the service inaugurated between Washington, Philadelphia and New York. The value was 24 cents. The rate was soon reduced. So many of the original issue were printed that uncanceled copies may be obtained without difficulty, but used copies on aerial mail are comparatively rare, especially those bearing the postmark of the first day's service.

Among the countries which have issued aeroplane stamps are Canada, Austria, Newfoundland, Germany, Hungary, Sweden, Switzerland, Esthonia, the United States of Colombia, Tunis and, more recently, the Belgian Congo. The Congo stamps are among the most beautifully engraved of all the aeroplane issues. There are four values, all printed in two colors. The 50-centime stamp is orange and black, showing a native trading station with an aeroplane overhead. The one-franc stamp in purple and black with an aeroplane flying over a village of native huts. The two-franc is blue and black, the scene depicting an aeroplane over a lake on the shores of which are Europeans and natives in long, narrow boats. The highest value, five francs, is green and black, with a view of a square-built tower over which the aeroplane is seen in flight.

For the service established in Spain last April, five of the current Spanish stamps were overprinted in black with the words "Correo Aero"—Air Post. They are used in the service inaugurated between Barcelona, Alicante and Malaga.

Tunis has just issued its second aeroplane stamp. The first appeared in May, 1919. The new one is a 30-centime stamp in olive and blue, with a view of the ruins of Hadrian's aqueduct. Over the scene appears the airman's winged badge in red.

Aero Club of St. Paul

The Aero Club of St. Paul is organized for the development of commercial aviation, with temporary office at Room 10, State Capitol, St. Paul, Minn. Its membership is growing and the following are officers and directors: President L. P. Ordway, Jr.; first vice-president, Otto N. Raths; second vice-president, S. W. Dittenhofer; third vice-president, Dr. E. W. Bunce; secretary-treasurer, Wm. B. McElveny; directors, Wm. C. Garis, W. A. Kidder, F. A. Nienhauser, and F. C. Hollman.

Pilot Rides Hurricane to Break Record

Jack Knight, air mail pilot, riding a De Haviland four plane, encountered a low-altitude hurricane forty-five miles west of Cheyenne, turned tail into the wind and flew at forty-five miles in seven minutes, or at the rate of 385 miles an hour or six and one-half miles a minute. Over the hangar in Cheyenne Knight faced the wind which exactly counteracted the push of his 400 horsepower Liberty motors and for twenty minutes the machine hung motionless over the landing field. He came down from his 3,000 feet altitude, nose to the wind, by a series of side slips and descended the last 200 feet almost vertically with all power on, landing safely.

Weather Data Available for Aviators

Recognizing the importance to aviators of information concerning conditions in the upper regions of the earth's atmosphere, the Weather Bureau took early action, after the possibility of navigating the air became assured, to develop means for securing a knowledge of these conditions.

Observing stations, equipped with appliances for sending into the upper atmosphere delicate instruments devised to measure the temperature, moisture, and other conditions of the air, were soon in operation. Other means were devised for measuring the velocity of the winds at different levels above the earth, and for studying the directions of the main air streams, and other important facts about the weather, a knowledge of which is necessary to the safety of the aviator and, to the successful application of flying, to the business interests of the country.

Extensive summaries of these investigations, which have been prepared and published from time to time, have been widely distributed.

In addition to a knowledge of the conditions existing at various elevations above the earth, the aviator is much concerned with surface weather, as the success of many of the operations preparatory to flying depends upon the conditions existing in the immediate vicinity of the landing fields, as well as over the territory between.

Data showing in great detail the general surface weather factors for all parts of the country have been prepared by the bureau as opportunity afforded, and these have likewise been given wide distribution.

Copies of practically all climatological summaries may be consulted in many libraries and other public institutions and at the Weather Bureau offices in the United States, about 200 in number, located in practically all the larger cities. Persons desiring weather information may usually find it convenient to call at a local Weather Bureau office, or application may be made by letter, either to the central office in Washington or to the nearest local station.

Prompt information is always forthcoming upon any reasonable request, but inquiries should be limited to actual needs as far as possible.

Arkansas City Aerial Frolic

An aerial frolic, the proceeds of which are to be devoted to the erection of permanent hangars, was carried through at Arkansas City, Kansas, on December 12 and 13. Over eight thousand spectators witnessed the various events and great local enthusiasm prevailed. Most of the army men participating in the event were from Post Field, and they included:

Lieut. Wm. E. Lynd, Lieut. H. A. Johnson, Lieut. Harry H. Mills, Lieut. Joseph H. Davidson, Lieut. Geo. H. Beverley, Lieut. J. T. Morris, Lieut. C. P. Prime, Lieut. Donald Wilson, Lieut. Russell H. Cooper, Chester F. Colby and Everett L. Pond.

Wants An Aeroplane to Carry "Dry" Raiders

Chicago.—Frank D. Richardson, Prohibition Director for this district, said that he was sending an appeal to Washington for an army aeroplane for use in surprise raids on towns like Hurley, Wis., in which the Prohibition law had been broken. "Dry" agents who entered Hurley found the news of their coming had preceded them.

"What we need," Mr. Richardson said, "is an aeroplane. We have the man who can operate it. Captain Lee J. Hanna was a flying man during the war. An aeroplane would also be valuable for patrolling the border and gathering information on booze runners."

Navy Wins Blimp Race at Winter Air Tournament

Long Beach, Cal.—The U. S. Navy won the eight-mile dirigible race at the Winter Air Tournament December 27th, beating a Goodyear pony blimp by one hundred feet.

A Martin torpedo-plane and two Navy Vought machines gave an exhibition of battle tactics.

The three days' flying meet was particularly successful, officials assert. There were no accidents. The various events were witnessed by large crowds, and it is believed that the tournament has materially advanced commercial aviation on the Pacific coast.

Line-up of passengers for the first trip of the Lawson midnight airliner, recently completely described in Aerial Age

CONTEST COMMITTEE'S REPORT OF PULITZER TROPHY AEROPLANE RACE

Mitchel Field, Long Island, N. Y.

November 25, 1920

CONTESTANTS FINISHING RACE

Position	Aeroplane	Pilot	Racing No.	TIME 1st Lap Min. Sec.	Time for 2nd Lap Min. Sec.	3rd Lap Min. Sec.	4th Lap Min. Sec.	Total Elapsed Time Min. Sec.	Motor	H.P.	Ignition	EQUIPMENT Spark Plugs	Carburetor	Fuel	Oil	Propeller	Thermometer	Tachometer	Air Speed Indicator	Altimeter	Tires
1st	Verville-Packard	C. C. Mosley 1st Lt., A.S.	63	11 6.70	11 0.37	11 7.18	11 15.32	44 29.57	Packard	600	Delco	A-C	Packard	50% Gas 50% Benzol	Mobile B	McCook Field	Boyce	Van Sicklen	Sperry	Taylor	Gdyr Aero Cord
2nd-1st CC	Thomas-Morse	H. E. Hartney Capt., A. S.	41	11 52.31	11 50.09	11 48.80	11 28.83	47 0.03	Wright	300	Dixie Magneto	A-C	Stromberg	80% Gas 20% Benzol	Wolfshead No. 8	McCook Field	Boyce Type C	Sig. Corp Type A	None	Sig. Corp Type D	Goodyear
3rd	Ansaldo	Albert Acosta	56	12 58.14	13 4.05	12 59.91	12 55.52	51 57.62	S.P.A.	225	Olivetti Mag.	K.L.G.	Zenith	68-70° Gas	Oilzum	Ansaldo	Founier	Jaeger	None		Pirelli
4th-2nd CC	(Curtiss) Ordnance	St. Clair Street 1st Lt., A.S.	45	13 13.10	13 16.67	13 3.21	12 44.04	52 17.02	Wright	300	Dixie Mag.	A-C	Stromberg	80% Gas 20% Benzol	Wolfshead No. 8	McCook Field	Boyce	Van Sicklen	None	Type D	Gdyr Aero Cord
5th-1st V	Vought V.E. 7 (Naval Aircrft Fac.)	A. Laverents Lt., U.S.N.	22	13 57.50	13 55.64	13 51.38	13 54.67	55 39.19	Wright	180	Dixie Mag.	A-C	Zenith	68-70° Gas	Mobile B	S-E Prop.	Boyce	Navy	None	Foxboro	Goodyear
6th	DeHaviland (Fisher Body)	J. P. Roullot 1st Lt., A.S.	14	14 35.33	14 15.95	13 48.37	13 26.93	56 6.58	Ford L8berty	400	Delco	Goodnough	Zenith	68-70° Gas	Oilzum	L.W.F.	Boyce	Sig. Corp Type A	None		Goodyear
7th-1st DH	DeHaviland (Curtiss)	Carl Eliason 2nd Lt., A.S.	1	14 11.73	13 53.87	14 0.11	14 3.68	56 9.39	Liberty	400	Delco	B-G	Zenith	68-70° Gas	Liberty		Boyce	Sig. Corp Type A	Foxboro Type	Foxboro	Gdyr. Aero Cord
8th-2nd DH	DeHaviland (Dayton-Wright)	J. B. Wright 2nd Lt., A.S.	2	14 14.89	14 11.00	14 11.28	14 15.03	56 52.20	Ford Liberty	400	Delco	A-C	Zenith	68-70° Gas	Liberty	Eagle Mfg by B. Shoninger	Boyce Model G	Sig. Corp Type A	Bristol		Goodyear
9th	DeHaviland	C.M.Cummings 2nd Lt., A.S.	19	14 18.03	14 18.63	14 15.85	14 15.61	57 8.12	Liberty	400	Dixie	B-G	Zenith	68-70° Gas	Liberty			Sig. Corp Type A	Foxboro Type	Foxboro	Goodyear
10th	DeHaviland	D. L. Conly Lt. (jg) U.S.N.	18	14 29.84	14 25.47	14 22.31	14 23.14	57 40.76	Ford Liberty	400	Delco	A-C	Zenith	68-70° Gas	Mobile BB	Dayton-Wright	Boyce	Sig. Corp Type A	Foxboro		Goodyear
11th	DeHaviland	H. N. Heisen Capt., A.S.	17	14 37.04	14 26.07	14 40.90	14 31.27	58 15.28	Liberty	400	Dixie	Mosler	Zenith	68-70° Gas	Mobile A	McCook Field	Sig. Corp	Sig. Corp	Sig. Corp		U. S.
12th	DeHaviland (Fisher Body)	V. C. Finch Lt. (jg) U.S.N.	3	14 36.87	14 35.60	14 34.16	14 46.31	58 32.94	Lincoln Liberty	400	Delco	Mosler	Zenith	68-70° Gas	Mobile B	Westmore	Boyce	Van Sicklen	Foxboro		U. S.
	Ansaldo	W. R. Taylor 2nd Lt., A.S.	54	14 54.64	15 1.57	14 43.36	14 56.02	59 35.59	S.P.A.	225	Olivetti Mag.	B-G	Zenith	68-70° Gas	Oilzum	Ansaldo	Founier	Jaeger	None		Pirelli
xx 13th-1st SE	S. E. 5	Maxwell Kirby Capt., A.S.	35	15 14.47	14 46.04	14 45.43	14 56.73	59 42.67	Wright	180	Simms Mag.	A-C	Zenith	68-70° Gas	Oilzum		British C.S.I. Co.	Van Sicklen	None		
14th-2nd V	Vought V.E. 7	W. B. Gwyn Lt. (jg) U.S.N.	21	14 55.07	14 40.29	14 52.31	15 23.96	59 51.63	Wright	180	Dixie Mag.	A-C	Stromberg	68-70° Gas	Wolfshead No. 8	McCook Field	American Gauge Co.	Jones-B	None	Taylor	Goodrich-U. S.
15th	DeHaviland (Fisher Body)	Lawrence Claude 2nd Lt., A.S.	12	15 21.04	14 49.04	14 47.54	14 59.11	59 56.73	Ford Liberty	400	Delco	B-G	Zenith	68-70° Gas	Liberty	Dayton-Wright	Type D	Sig. Corp Type A	Foxboro		Goodyear
16th	Vought V.E. 7	L. H. Sanderson 2nd Lt., U.S.M.C.	23	15 8.32	14 59.83	14 59.92	15 1.31	60 9.38	Wright	180	Dixie Mag.	A-C	Stromberg	68-70° Gas	Mobile B	Am. Prop. Mfg. Co.	Boyce-Navy Type	Jones-B	Navy-Zahm Type		Goodyear
17th	DeHaviland (Fisher Body)	W. R. Lawson 1st Lt., A.S.	5	14 57.35	15 19.15	15 14.54	15 17.42	60 48.46	Marmon Liberty	400	Dixie	B-G	Zenith	68-70° Gas	Liberty	"Imperial"			None		Goodyear
18th	DeHaviland (Curtiss)	H. B. Mims Capt., U.S.M.C.	6	15 23.19	15 28.69	15 4.33	14 53.13	60 49.34	Liberty	400	Delco	A-C	Zenith	68-70° Gas	Mobile A		Boyce Model C	Sig. Corp Type A	Foxboro		
19th	DeHaviland	Lucas V. Beau 2nd Lt., A.S.	11	15 66.96	14 57.86	14 59.30	14 57.50	61 1.62	Lincoln Liberty	400	Delco	A-C	Zenith	68-70° Gas	Liberty	Eagle Prop. Co.	Boyce	Sig. Corp Type A	Foxboro		Gdyr. Aero Cord
20th	Vought V.E. 7	W. V. Brown 2nd Lt., U.S.M.C.	24	15 5.52	15 32.51	15 35.08	15 12.17	61 25.28	Wright	180	Dixie	Mosler & A-C	Stromberg	68-70° Gas	Mobile B	Am. Prop. Mfg. Co.	Boyce-Navy Type	Jones-Navy Type B	Foxboro		Goodyear
21st	DeHaviland (Curtiss)	R. C. Moffatt 2nd Lt., A.S.	15	15 29.02	15 20.37	15 49.23	15 8.83	61 47.45	Liberty	400	Delco	B-G	Zenith	68-70° Gas	Liberty	Eagle Propeller Co.			None		Goodyear
22nd	Vought V.E. 7	J. K. Dunn Gy Sgt. U.S.M.C.	25	16 2.39	15 36.25	15 7.26	15 4.48	61 50.38	Wright	180	Dixie	Mosler & A-C	Stromberg	68-70° Gas	Mobile B	Am. Propeller Co.		Jones	None		Goodyear
23rd	DeHaviland	Norbert Carolin Capt., A.S.	8	15 47.88	15 49.18	15 43.65	15 18.51	62 39.22	Liberty	400	Delco	B-G	Zenith	68-70° Gas	Liberty		Sig. Corp Type D	Sig. Corp Type A	Type B		Goodrich
24th	Morane Saulnier	Charles Colt	57	16 53.89	16 36.24	19 21.77	20 24.43	73 16.33	LeRhone	110	LKVG Mag.	Mosler	LeRhone	68-70° Gas	Castor	Levasseur	None	Jaeger	None		

CONTESTANTS FAILING TO FINISH RACE

Aeroplane	Pilot	Racing No.	TIME 1st Lap Min. Sec.	2nd Lap Min. Sec.	3rd Lap Min. Sec.	Motor	H.P.	Ignition	Spark Plugs	Carburetor	Fuel	Oil	EQUIPMENT Propeller	Thermometer	Tachometer	Air Speed Indicator	Tires	Reason for Withdrawal
Curtiss Kirkham	W. D. Culbertson 2nd Lt., U.S.M.C.	62	11 3.34	12 11.94	12 18.18	Curtiss-Kirkham	450	Berling Mag.	Mosler	Ball & Ball	68-70° Gas	Castor & Mobile B	Curtiss D.9' P.10 3-4	Boyce	Jones	Sperry	Goodyear	Broken conn. rod; forced landing without further damage.
Loening Special	B. G. Bradley Lt., U.S.M.C.	46	12 38.51	12 25.22	12 35.14	Wright	300	Dixie Mag.	A-C	Stromberg	80% Gas 20% Benzol	Wolfshead No. 8	Hartzell D.8' P.8' 3"	U.S. Navy Type	U.S. Navy Type	None	Goodyear	Alum. water conn. cracked; motor seized; forced landing; landing gear fuselage damaged.
SE-5	A. E. Simonin Lt., A. S.	31	14 57.34	14 46.80	15 5.66	Wright	180	Dixie Mag.					English			None		Pilot believed he had finished race.
Vought VE-7	W. J. Daly Ensign, U.S.N.	26	18 32.59	18 47.92	18 51.63	Wright	180	Dixie Mag.	A-C	Stromberg	60-70° Gas	Mobile B	McCook Field		Jones-B	Zahm Type	Goodyear	Motor overheated; forced landing without damage.
Ansaldo	A. W. Fox	52	13 27.63	15 21.07		S. P. A.	225	Olivetti Mag.	K.L.G.	Zenith	68-70° Gas	Oilzum	L.W.F.	Founier	Jaeger	None	Pirelli	Pilot reported he could not see due to fogged goggles.
DeHaviland (Hospital Plane)	E. H. Barksdale 1st Lt., A.S.	65	15 5.90	14 52.23		Liberty	400	Delco										Returned Mitchel Field.
DeHaviland (Dayton-Wright)	F. O. Rogers Lt., U.S.M.C.	16	15 42.16	15 2.25		Liberty	400	Delco	B-G	Zenith	68-70° Gas			Sperry	Sperry	Sperry	Goodyear	Broken valve, piston, connec. rod. Forced land. without further damge.
SE-5	S. M. Aimes 2nd Lt., A.S.	32	16 7.68	15 51.51		Wright	180	Dixie Mag.	A-C	Stromberg	68-70° Gas	Mobile A	SE Prop		Signal Corp	Markiva		Motor overheated. Returned Mitchel Field.
Curtiss Kirkham	W. B. Haviland Lt. Com., U.S.N.	61	12 35.32			Curtiss-Kirkham	450	Berling	Mosler	Ball & Ball	68-70° Gas	Castor & Mobile B	Curtiss D.9' P.10' 6"	Boyce	Victometer-Jones	Sperry	Goodyear	Carburetor or gas line trouble. Returned Mitchel Field.
Thomas-Morse	Leigh Wade 2nd Lt., A.S.	43	12 37.47			Wright	300	Dixie Mag.	A-C	Stromberg								Broken drift wire. Returned Mitchel Field.
DeHaviland	Davenport Johnson Major, A.S.	7	14 48.80			Ford Liberty	400	Delco	B-G	Zenith	68-70° Gas	Mobile BB	Morris & Co.	Boyce	Van Sicklen	Precision Instr. Co.	Goodyear	Motor went dead, cause unknown. Forced lndng.;'plane badly damaged.
SE-5	F. A. Johnson 2nd Lt., A.S.	34	15 4.23			Wright	180	Dixie Mag.	A-C	Stromberg	68-70° Gas		Liberty	Type A	Van Sicklen	Smith		Motor overheated. Returned Mitchel Field.
Loening	P. E. Gillespie Lt. (jg.), U.S.N.	51	15 11.21			Wright	300	Magneto	B-G	Claudell	68-70° Gas	Wolfshead No. 8					Goodyear	Motor overheated. Returned Mitchel Field.

CONTESTANTS FAILING TO START

Aeroplane	Pilot	Racing No.	
Young Special	O. Young	64	Did not report.
SE-5	F. Steinle Capt., A.S.	33	Did not start—gas in radiator overheated on ground.
Fokker	C. H. Wash Major, A.S.	42	Overturned in snow at Buffalo.

Aeroplane	Pilot	Racing No.	
Ordnance	O. C. Kelly 2nd Lt., A.S.	44	Damaged in collision on Mitchel Field before start.
Sopwith Dolphin	C. E. Haynes 2nd Lt., A.S.	47	Did not report.

Aeroplane	Pilot	Racing No.	
Loening	J. F. Wolfer Lt. (jg), U.S.N.	55	Damaged in collision on Mitchel Field before start.
DeHav land	R. W. Brown 2nd Lt., A.S.	4	Did not report.
DeHaviland	M. D. Mann 2nd Lt., A.S.	9	Did not report.

1st CC—Winner Contest Committee's Invitation Class Prize. 2nd CC—Second Place in Contest Committee's Invitation Class Prize. 1st DH—Winner of DH Class Prize. 2nd DH—Second Place in DH Class Prize. 1st SE-5—Winner of SE-5 Class Prize. 1st V—Winner of Vought Class Prize. 2nd V—Second place in Vought Class Prize. *x*—Special rigging, not eligible for DH Class Prize. *xx*—Disqualified for cutting pylon at Lufberry Field on last lap.

The Contest Committee believes this report to be accurate, but, as much of the information contained therein had to be obtained from the contestants, mechanicians, etc., there may be some errors. We request anyone finding any errors in the report or having additional information not contained therein, to notify us in order that we may, at a later date, issue a supplementary report.

The AIRCRAFT TRADE REVIEW

Goodyear Wins Point

Columbus, Ohio.—Common Pleas Judge Kinkead on December 23d sustained a motion to quash summons in the suit filed by Frank S. Monnett, a minority stockholder in the Goodyear Rubber Company, asking appointment of a receiver for the company. This nullifies the action in this county, it was said, unless service can be made on an agent.

At the same time the court sustained a demurrer filed by F. V. Freeman, local broker, named in the Monnett suit as a defendant. Freeman asserted he had no connection with the case and should not have been named in the suit.

There are no company agents in Franklin County, it was asserted by counsel for the rubber company, on whom summons could be served.

"Paquito" Dinner

Prominent aeronautical and automobile experts were elaborately entertained at dinner in the Automobile Club of America, on November 23, by E. H. Morrice. During the dinner Mr. Morrice gave a private demonstration of "Paquito," a revolutionary invention for the ignition of explosive engines, a device which if successful will play an important part in the ignition development of all motors.

Brig.-Gen. William Mitchell, Assistant Chief of Air Service; David Beecroft, E. H. Morrice and D. Bruce Morgan spoke. Others included Glenn H. Curtiss, Vital Paquit, inventor of the device; F. S. Duesenberg, Charles M. Manly, Maurice Pereles, Capt. Burdette S. Wright, Fay L. Faurote, W. Kenneth Watkins, L. D. Gardner, Rowland Chilton, H. W. Slauson, J. Tracy, L. M. Griffith and Dr. W. E. Deeks.

Dirigible Operation Laid Over for a Time

Akron.—Ralph Upson, the only American to win the James Gordon Bennett International Balloon Race Trophy, and until recently chief aeronautical engineer of the Goodyear Tire & Rubber Co., has abandoned, temporarily at least, his plans for formation of a large aeronautical syndicate for the manufacture of dirigibles and control and operation of inter-city passenger and express dirigible service. Upson, upon leaving Goodyear two months ago, stated that at that time he had under definite consideration a proposal which it is understood came from a group of prominent men who were ready to provide ample financing, to launch such a dirigible project, and to devote his time to the perfection of an entirely new and more feasible type of lighter-than-air craft.

The current financial and business depression has resulted in deferment of all such plans. Upson is now in Washington in the capacity of consulting aeronautical engineer for the Government, in assisting he Navy and War Departments.

Curtiss Sues Handley Page

New York.—The Curtiss Aeroplane & Motor Corp. has brought two patent infringement suits in the United States District Court against Handley Page, Ltd., and the Airplane Disposal Co., another English corporation. Ten patents are involved in the litigation, which is based on efforts of the defendants to sell in this country surplus war planes which were purchased from the British Government.

Japan Buys Engine Rights

Licenses for the construction of all types of Lorraine-Dietrich aviation engines have been sold to the Imperial Japanese Government. At the present time Japanese engineers and skilled artisans are at the Lorraine-Dietrich factory, near Paris, obtaining instruction in the building of these engines. As soon as sufficiently advanced, it is intended to build the engines in Japan. The Lorraine-Dietrich line consists of 6, 12, 18 and 24-cylinder engines, varying from 150 to 1,000 h.p. The type which is of greatest interest to the Japanese is the 12-cylinder 500 h.p., with Delco ignition. This engine has a bore and stroke of 126 by 200 mm.

Allies Release Planes Consigned to Larsen

New York.—Information has been received that eleven all-metal Junker aeroplanes consigned to the United States but held up at Hamburg by the Inter-Allied Commission of Control, have been ordered released. It has been learned that these machines are being shipped to John Larsen, who is the Junker's representative in this country and who introduced the all-metal planes to the United States by selling them over the counter at $30,000 each to the Post Office Department. It is presumed the machines will come into the country through Baltimore. Larsen, it is said, expects to sell 400 Junker planes in this country before May. Several have been ordered by the Navy Department.

Goodrich Reorganizes Engineering Division

Akron.—Under S. B. Robertson, director of engineering of the B. F. Goodrich Co., who succeeded George Perks in that capacity, the Goodrich engineering department has been reorganized and put upon an entirely new and unique basis, with B. H. Clingerman, formerly managing power engineer, now in the capacity of consulting engineer for the company.

Clingerman has been with the Goodrich Co. for over two years. Under the reorganization announced by Robertson, J. H. Vance, former superintendent of power becomes power engineer. W. C. Hoover is the designing engineer, B. C. Mitchella, the structure engineer, E. D. Barry, material engineer; V. A. Parker, molding engineer, and W. F. Pierce, master mechanic. E. F. Myers and F. E. Blower are assistant master mechanics and W. P. Sheely is chief inspector.

The S. A. E. Aeronautic Sessions

Such a wealth of interesting material has been made available for the S. A. E. Aeronautic Session that it has become necessary to hold *two* Aeronautic Sessions during the winter meeting—one on Tuesday evening, January 11th, and the other on Wednesday afternoon, January 12th—at both of which Glenn L. Martin will preside. The Tuesday evening session will be known as the Aeronautical Engineering Session and will be devoted to papers on recent developments in aviation. Major Thurman H. Bane, of McCook Field, whose entertaining talk and motion pictures at the summer meeting will be remembered, has some new pictures to illustrate his talk on "Progress in Military Aviation." Grover C. Loening's paper will be called "Design Requirements of Commercial Aviation." C. D. Hanscom will give a paper on "Aeroplane Wings" and F. W. Caldwell will tell of recent developments in "Aeroplane Propellers."

"Commercial Aviation Session," is the name given to the Aeronautic Meeting on Wednesday afternoon, in which this subject will be discussed from several points of view. Glenn L. Martin, the chairman of the session, will talk briefly on "Commercial Aviation" in general. Prof. Edward P. Warner, of the National Advisory Committee for Aeronautics, who has recently returned from a trip abroad, will present some first-hand information on "Commercial Aviation in Europe," and Ralph H. Upson has a comprehensive paper on "Transportation of the Immediate Future."

It is to be noted especially that these aeronautic sessions will replace the annual Aeronautic Meeting and Dinner heretofore held at the time of the Aero Show, because of the improbability of there being a Show in 1921.

Personal Pars

Friends of Lieutenant (jg) T. M. Colston, U. S. N. R. F.-5, were pleasurably surprised to learn of his marriage at San Diego, December 8th, to Miss Emma Taylor, of Memphis, Tenn.

First Lieutenant W. H. Bleakley has assumed command of "B" Flight at March Field, vice First Lieutenant H. H. George. Lieutenant Bleakley was one of the first Gosport instructors in this country.

New Company Formed

The Bauhaus Aviation Company of Carpinteria, California, have developed a new two-place type ship which they expect to put into production shortly.

The new company is being backed by local capital and the plant and home office will be located at Carpinteria.

Kinner Leases Field

The Kinner Airplane and Motor Corporation of Los Angeles recently leased their aviation field known as "Kinner Airport" to Miss Neta Snook, who is at present the only lady flyer in Southern California engaged in passenger carrying.

Miss Snook expects to establish about December 1, an aerial tour known as the Orange Empire Air Voyage, taking in the towns of Santa Ana, Corona, Riverside, San Bernardino, Pasadena and Los Angeles.

Miss Snook has the reputation of being one of the best lady pilots in the Middle West.

THE AERONAUTICS OF THE FLYING FISH

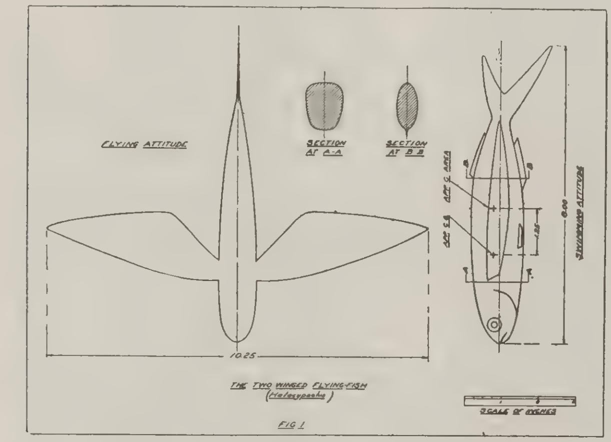
By R. E. DOWD *

WHILE it is generally known that certain species of fish travel through the air with the aid of enlarged pectoral or breast fins, reports of the truly remarkable flights of these creatures are seldom accepted with credence, much less, consideration. Much has been written on the subject from a naturalist's standpoint, but this, unfortunately, has been largely of a controversial nature. The point usually at issue is, whether or not the "wings" are flapped in flight. The writer does not wish to add to the already voluminous literature on this point, but the results of his flying fish study from an aeronautical standpoint have been so intensely interesting to him that he now gathers together his fragmentary notes in the interest of that great unexplored field, Natural Flight.

He wishes to express appreciation of the companionable co-operation and assistance of his friend, John Treadwell Nichols of the American Museum of Natural History, in collecting of data, etc.

There are two families of flying fish—the family Triglidæ or Flying Gurnards, so called, and the family (Exocoetidæ) sometimes called Flying Herrings. The Flying Gurnards, of which there are but few species, have great butterfly breast fins and make only extended leaps through the air. The wings, as might be expected from their low aspect ratio, are inefficient and the performance poor. The other family of flyers, of which there are 50 or more species, is the object of our study. We shall, however, confine our treatise to two very representative species, the first, the Halocypselus evolans, popularly called the Two-winged Flying Fish, and the other (Exonautes speculiger), known as the Four-winged Flying Fish. Both occur cosmopolitan throughout the warm seas.

Fig. 1 is an outline drawing of a fairly representative specimen of the Two-winged species. We are at once impressed with the wonderful streamline body and excellent proportions of this creature, which seems to trespass into the aerial domain with such confidence and success. The lower lobe of the caudal fin or tail is enlarged so that symmetry is no longer present. In passing we might note that this lower lobe enlargement is directly the reverse of the order in tails of the sharks, which, it is generally agreed, are the ancestors of all fishes. Intensive use in sculling the body along close to the water is the reason for this abnormal development. The large shoulder is necessary to house the pectoral muscles and control mechanism, and the unusually large eyes we might expect are the result, in one way or another, of its aerial travels, since they are characteristic of these creatures.



THE TWO WINGED FLYING-FISH (Halocypselus)

FIG 1

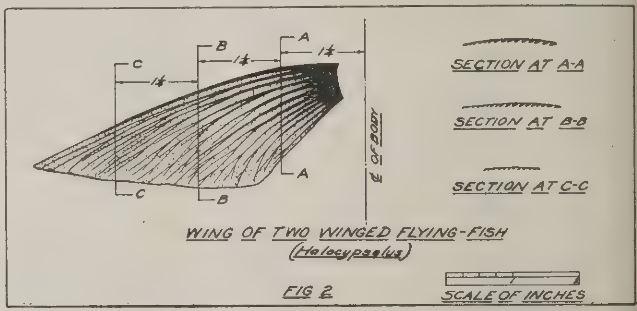
The arenonautical characteristics of this specimen are as follows:

Span—10.25 inches when expanded to flight attitude.
Length (overall)—8.00 inches.
Aspect ratio—10.25.
Mean chord—1 inch.

Wing section and construction: Fig. 2 shows the expanded wing in detail. It is composed of a framework of diverging rays which, as they progress outward, divide and branch out so that the total area is very effectively covered. The rays are more or less triangular in section and are covered with a sort of membranous skin on the upper surface. After much difficulty, the writer has secured the reconstructed profiles as shown by imbedding a wing in paraffin and cutting it into sections. The under-surface projections are noteworthy. Without crediting this strange creature with aero-dynamical intelligence, one must acknowledge that Mother Nature has shown better adherence to fundamental principles than did our pioneers, who covered only the lower surface of their wings. When folded, the rays lay very compactly against one another, so that water resistance is minimized.

Weight—.15 lbs.
Area—.071 sq. ft.
Loading—2.1 lbs. per sq. ft.

Velocity. Being greatly variable, the velocity is exceedingly difficult to determine, but careful observation of the relative speed to a ship whose velocity is known puts it at an average of about 30 m.ph. Since the presence of a wind would alter this figure considerably, the matter is largely one of guesswork. However, let us assume for the time being, that it is 30 m.p.h., and enter into a little computation for the purpose of comparison. Not knowing the characteristics of the wing, it is interesting to take the characteristics of a typical everyday section in order to get an idea of the approximate angle of incidence.



WING OF TWO WINGED FLYING-FISH (Halocypselus)

FIG 2

Coefficient of lift, or K_y at 30 m.p.h. must be .0025, which corresponds to about 8.5 degrees for the well known R A F-6 section. This is obviously high, and if the wing is less efficient than the R A F-6, as it probably is, an even greater angle would be required for sustentation. Doubtless, we have underestimated its velocity, although we shall see from its performance that perhaps this particular species is required to use a high angle of incidence though probably not so great as 8.5 degrees.

Performance. A long, though not record, flight of this species and size will be described. Pursued by their nautical enemies, the dolphins or bonitos, they emerge from the water at high speed, spread their pectoral fins which we may call wings and take the air immediately. However, if no danger lurks, the lower lobe is used just after emerging and spreading wings to scull the water in a very vigorous manner so that flying velocity is attained with only air instead of water resistance opposing progress. During this start the wings are often seen to vibrate but only momentarily, for the fish quickly climb upward in graceful swift flight to a usual maximum height of about 12 feet and after a flight of approximately 300 feet or slightly more, re-enter the water with wings folded. Distances much greater and heights up to 25 feet are occasionally recorded, but these are undoubtedly the result of happy-made-to-order air conditions. The quick climb and comparatively short flight would indicate that the incidence and consequently total resistance was high so perhaps our velocity assumption is not so much in error as the high incidence indicated.

The Four-Winged Species

Fig. 3 is an outline drawing of the four-winged species. This species is by far the better flyer. In it we find the ventral or rear fins also enlarged and are of unquestionable value in directing and stabilizing flight as well as furnishing additional lifting area. Its aeronautical characteristics are as follows:

Span (front wings)—12.37 inches.
Length overall—10.50 inches.
Mean chord—1.1 inches.
Aspect Ratio—Approx. 11.
Wings—Same construction as in Two-winged species.
Weight—.27 lbs.
Total area—.112 sq. ft.
Loading—2.4 lbs. per sq. ft.
Velocity—About 45 m.p.h. from extensive observations.

Coefficient of lift or K_y, at 45 m.p.h., .0011. This corresponds to an angle of incidence of about 2.5 degrees for

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* Paper read before Aero Club of Ithaca, Dec. 16, 1920.

R A F-6, a very efficient flying angle which may be taken as the reason for the more extended flights of this species.

Performance. The get-away is very similar to that of the two-winged species, but its long flights sometimes cover distances of six to seven hundred feet at maximum ordinary heights of nine feet. Under windy conditions ¼ and even ½-mile flights have been recorded and heights of 20 feet attained. Often the fish allows its tail to touch the water, after a considerable distance has been traveled, to scull along thereby getting a fresh start for another aerial excursion. The flight following each tail touch is, however, shorter and less energetic, probably due to muscular fatigue.

The Flapping Question

An examination of a flying fish's wing soon convinces one that, ingenious though it may be in structure, it could never reproduce the complicated muscle-propelled cycle called a flap as we see it practiced daily by the smaller flapping birds. Then, too, we have seen that the loading is greater than 2 lbs. per sq. ft., while, in the flapping kingdom, the swallow, with practically equal span and area, is loaded less than a quarter lb. per sq. ft., in accordance with Nature's law "The smaller the flyer, the lighter the loading". It seems that this creature is not intended to propel itself by flapping. An examination of ratio of muscle weight to total weight confirms this belief. The breast or pectoral muscles of a pigeon for example, are equal approximately to 1/5 of its total weight while Dernford gives approximately 1/32 for the same ratio in flying fish. With heavier loading, inferior wings for flapping, and only 1/6 as much proportional muscular energy it is difficut to conceive of real flapping flight by flying fish. What then is the phenomenon that has been so recorded as "flapping" by our conscientious naturalists? The vibrating of the wings, prior to taking the air, Jordan thinks, is the result of the vigorous shaking of the whole body as the tail is propelling the fish. However, as Hankin points out, the vibration is in the horizontal plane and the supposed cause in the vertical plane. In the writer's opinion, if the cause lies in that direction at all, it is due rather to the pectoral muscles' functioning in sympathy with the vigorous exertion of the tail muscles. However, the real explanation seems to be that the noted vibrations, admittedly feeble and small in amptitude, are simply an indication of the feeble control the fish has over its wings until firmly spread and the flight under way. That is to say, the wings are spread, the tail worked for propulsion and when the air is acting properly on the wings, the flight begins. The so-called flapping occurs almost invariably during the critical period after unfurling and just prior to flight. This theory is further strengthened by the not infrequent plunging of the fish back into the water during the "flapping period". This apparent involuntary descent might be attributed to the air's getting into the upper surface before sufficient rigidity had been provided by muscular tension.

Gliding Angle

We have, of course, no exact data on the resistance coefficients of the vaious component parts of these fish, but they conform so closely to tested shapes that computation is possible for an investigation of this nature.

Two-Winged Species

Maximum Sectional Aera of Body—.007 sq. ft.
Fineness Ratio—Approximately 8.
Assumed K_x—.0005.
Velocity—30 m.p.h.
Resistance—
Fins and body... .003 lbs.
Wings at L of 12 .012 lbs.
D .015 lbs.—Total resistance.

Now if we may use that much debated $\frac{\text{Weight}}{\text{Resistance}}$ for an approximation of the gliding angle we have:

$$\frac{\text{Wt.}}{\text{R}} \text{ or } \frac{.15}{.015} = 10 = \text{Gliding Angle.}$$

Four-Winged Species

Maximum Sectional Area—.0011 sq. ft.
Fineness Ratio—Approximately 8.
Assumed K_x—45 m.p.h.
Velocity—45 m.p.h.
Resistance—
Fins and body .011 lbs.
Wings at L = 16 .016 lbs.
D .027 lbs.—Total resistance

$$\frac{\text{Wt.}}{\text{R}} \text{ or } \frac{.27}{.027} = 10 = \text{Gliding Angle.}$$

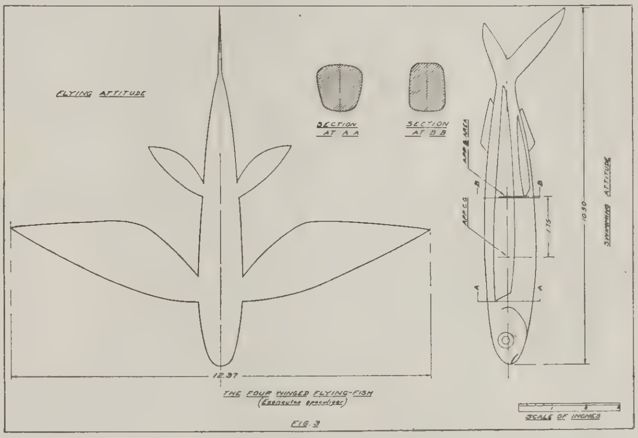
Strangely enough both work out to have a gliding angle of about 1 in. 10, which is of course very good aerodynamically. It is readily seen, however, that at the maximum heights attained, 20 or 25 feet, the performance is a great deal more than a glide. Let us then see if this interesting creature has sufficient control to utilize "wind energy" for it is an established fact that greater distances are covered when flying in a wind.

Control

That the flight is under intelligent and reliable control is certain. The absence of a real trajectory proves that the excursion is a "flight". The distance covered is far too great to be a glide. Therefore, some unaccounted for element enters into the problem. It is that same elusive element that sustains the great 11-foot albatross or the 7-foot Frigate bird hour after hour in effortless flight—the power in moving air. To utilize wind energy without control is impossible. Quite apart from any logical deduction we have the facts before us that longer flights occur in a wind and that fish come aboard ships frequently at night, but very rarely during daylight. Could further proof be desired of the power of controlability? Certainly not, but it will be interesting to see "how" it is accomplished.

The Two-Winged Species

Elevation: Only limited control is possible by changing camber and arching body. This limited control over elevation is fully sustained by observations. The incidence is undoubtedly increased to compensate for reduced velocity.



THE FOUR WINGED FLYING-FISH
(Exonautes speculiger)
FIG. 3

Direction: From Fig 1, we see that the center of lateral area lies approximately 1¼ inches back of the c.g., which would tend to make flights to windward common (as observed). The tail acting as a rudder with much ample keel surface forward makes directional control easy.

Lateral: Probably lateral control is largely inherent because of the extremely flexible wing tips and trailing edge. The lateral moment of inertia is very small which would also aid materially in preserving equilibrium. The enlarged lower lobe of the tail placing the great part of its area below the neutral axis of the body ought to be troublesome to lateral stability, but it is doubtless overcome by intelligent control.

The Four-Winged Species

Elevation: By using the ventral (rear) fins as elevators and by changing camber and incidence to compensate for reduced velocity towards end of flight. The greatly increased controlability of this species seems directly due to the ventral fin development.

Direction: The directional center is about 1¾ inches back of the c.g. and would therefore be favorable to upward flying, as in the two-winged species. The tail is used only for manoeuvers.

Lateral: Same as two-winged species.

Development Noted

As in the study of any living thing, we find organs developed abnormally under intensive use. The tail, the large eyes, the pectoral and ventral fins with their muscles are parts that draw our attention as pure developments. We note that the wings reach only to the base of the tail when folded. Quite logical, for greater length would doubtless hamper free tail action. We also note that when nature turned out a large flying fish, she took care to provide addition control for the inertias must necessarily increase greatly. The body section to the rear changed to rectangular when the ventral fins began to function as elevators. How logical! How mechanically perfect is this creature that many feel trespasses into our new realm of endeavor—the air.

Summary

Thus, we see that the flying fish instead of being a flying creature of feeble, uncertain flight and equally unscientific construction, is really another of Nature's wonderful organisms that actually fly—yes, and apparently evade payment to Father Gravitation for the compensating energy that we are yet compelled to pay for our present mode of flight. Without knowing principles, they use them in a way that man can only marvel at now. In years to come, however, it is the great hope of those who have studied soaring flight, that man will both know the principles and be able to utilize the power of "internal air energy", which seems to be at the complete disposal of so many of Nature's flying creatures.

EXPERIENCE WITH GEARED PROPELLER DRIVES FOR AVIATION ENGINES

By K. KUTZBACH

Translated from Technische Berichte, Vol. III, Sec. 3, by Starr Truscott, Aeronautic Engineer, Bureau of Construction and Repair, U. S. N.

(Concluded from last week)

II. General Arrangement of the Gear

In the construction of the gear drives for aeroplane engines the three principal rules of mechanical engineering apply with special force:

I. All load-carrying parts—gearing and housings—must be joined together in the most direct manner to obtain strength and rigidity.

II. Where a variation in distances between centers is unavoidable as a result of wear, or no exact assembly is possible, suitable provision must be made for adjustments.

III. Where a movement in the gears or housing is unavoidable or cushioning or yielding effect is necessary, sliding or elastic joints must be introduced in such a manner that the effect of the movement or yielding can be accurately determined or computed.

For air propeller drives single or double reduction gear drives can be used. The single reduction gears can be either spur gears, or internal gears, and as a rule work out simpler, lighter and cheaper than the double reduction drives. Consequently, they are the most common (Figs. 8 to 11). Practical experience with these gears and inspection of the teeth of their wheels shows that heavy wear takes place in all single reduction gears except the Hispano-Suiza (Fig. 11), in which the teeth generally bear splendidly. The worst bearing is in the teeth of those gears in which the driving pinion is fitted with a bearing on only one side of the wheel.

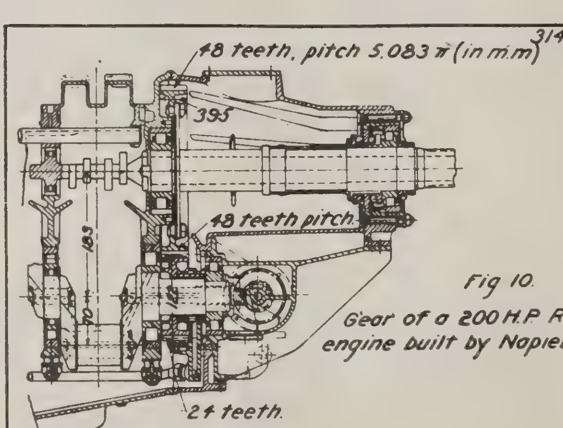


Fig 10.
Gear of a 200 H.P. R.A.F. engine built by Napier.

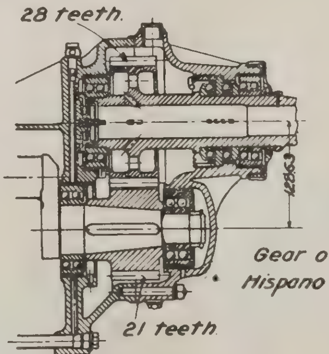


Fig. 11.
Gear of a 200 H.P. Hispano Suiza engine.

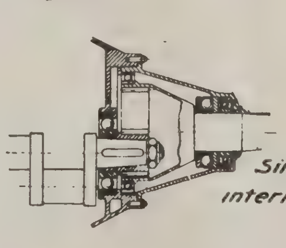


Fig. 12.
Single reduction internal gear by Birkigt.

Fig. 10, 11 & 12

Single reduction gears with internal gearing have not been captured as yet. However, Birkigt, designer for the Hispano-Suiza Works, has had such a gear patented in England (Fig. 12). A notable feature is the attachment of the internal gear housing to the crank case by an eccentric centering flange which makes it possible to accurately fix the play. Against the great advantages of the interial gear must be balanced the difficulty in arranging satisfactory bearings on both sides of the wheels. However, satisfactory solutions of this problem are not impossible.

Double reduction gears with two different pairs of wheels are principally used where the power must be delivered in the same axial line as the crankshaft. Their construction leads to many and varied solutions, since both pairs of wheels may be fitted with internal or external toothing and in addition any one of the three shafts may be fixed while the other two drive and are driven. In this manner alone 12 solutions are found which are assembled diagrammatically, and for a transmission ratio of 1:2, in Fig. 13. The solutions are arranged in the horizontal rows A, B_s, and B_k according to the motion of the intermediate shaft.

Row A Intermediate shaft fixed in housing.
B_s " " revolving with propeller.
B_k " " " " crankshaft.

(Rows B_s and B_k illustrate the planetary gears.) In addition, the vertical rows 1 to 4 are arranged according to the direction of rotation of the shafts. As will be understood, all the solutions are not of the same value for actual construction, since in different arrangements the provision of bearings on both sides of the gears makes more or less difficulty, the space occupied may be very great and the revolutions of the intermediate shaft may be very high.

For a better comparison the graphical computation has been added in Fig. 13 for each case. According to the well-known method the r.p.m. of the crankshaft (n_k) and of the propeller (n_s) have been laid off in magnitude and direction (relative to the fixed housing G) at the point G of the intermediate shaft Z (Fig. 14). If the spider R is fixed to the housing its r.p.m. is zero and its origin coincides with G. But, if it revolves itself, with r.p.m. n_k or n_s, then R is applied at the extremity of n_k or n_s (see Fig. 15). The r.p.m. of the intermediate gears relative to the spider R is assumed as to magnitude and direction as convenient. If now the extremity of n_z is joined to those of n_k and n_s, the intersections on the spider indicate the tangent points of the rolling circles.

In addition the double reduction gear can be constructed with spur gears or bevel gears.

The much simpler forms in which both pairs of wheels have one wheel in common form a special case (see Figs. 16 to 19). The form of Fig. 16 is developed from that of form A_1 of Fig. 13, the form of Fig. 17 from A_4, and of Fig. 18 from B_{s2}. It will be observed with this last that the transmission ratio is limited (to about 1:1.5). With the form of Fig. 19 a ratio of only 1:2 is possible.

The Rolls-Royce planetary gear is the best known (Figs. 21 to 23). In many details it is directly representative of the type. It is represented by the form B_{s2} of Fig. 13. The gear a revolves with the revolutions $+ n_k$ of the crankshaft, gears b and c with the relative revolutions $+' n_z$ in the spider i, which is more plainly shown in Fig. 23, and which in turn revolves with the revolutions n_s of the propeller, while gear d is held against revolving in the housing.

The advantage of the double reduction gear over the much simpler single reduction gear lies in the perfectly axial transmission of the power, from which the best condition of loading of the housing—pure torsion—is obtained. If the power is transmitted through 2, 3 or 4 intermediate gears at equal angles springing of the gear shafts from unequal peripheral forces or inaccurate tooth forms does not occur. Certain arrangements also make it possible to use heavy revolving masses; for instance, those of the intermediate shafts or the larger wheels with internal toothing, for the improvement of the uniformity of transmission and to avoid reversals of tooth pressures. The principal advantage, however, consists in the fact that on account of the load being divided between 2 to 4 intermediate gears the tooth pressures per unit of tooth face are very low. Consequently, small pitches and small gears can

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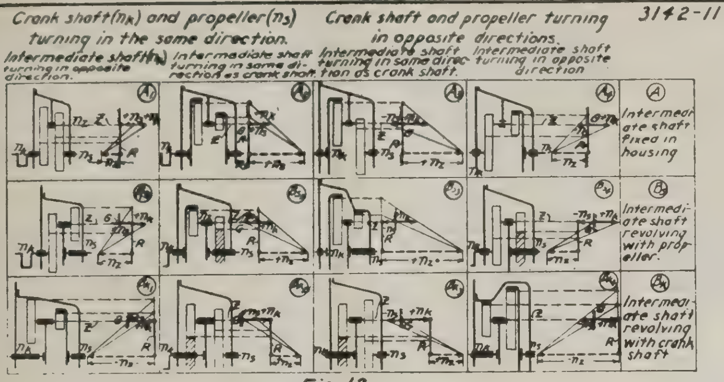

Crank shaft (n_k) and propeller (n_s) turning in the same direction.
Crank shaft and propeller turning in opposite directions.
Intermediate shaft (n_z) turning in opposite direction.
Intermediate shaft turning in same direction as crank shaft.
Intermediate shaft turning in same direction as crank shaft.
Intermediate shaft turning in opposite direction
A Intermediate shaft fixed in housing
B Intermediate shaft revolving with propeller.
Intermediate shaft revolving with crank shaft

Fig. 13.

Various arrangements of double reduction gears.

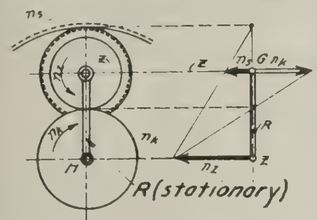


Fig. 14.

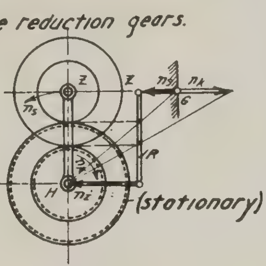


Fig. 15.

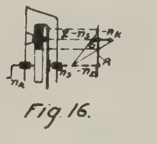


Fig. 16.

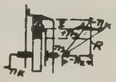


Fig. 17.

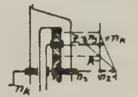


Fig. 18.

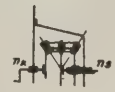


Fig. 19.

Double reduction gear in which the pairs of gears have a common gear.

Figs. 13, 14, 15, 16, 17, 18, & 19.

be used which in turn have smaller construction defects, since the defects resulting from inaccurate dividing wheels increase with increasing radius. The disadvantage of the double reduction gear is that it is relatively heavy and costly and makes great demand on the accuracy or exact adjustment of the intermediate shafts if all the gears are to work equally. Finally, the solid and secure assembly of the gear make necessary a series of connections which do away with the theoretical simplicity of the type.

In accordance with the first law of light machinery construction—that all load-carrying parts are to be joined together as rigidly and unvaryingly as possible—it is best to fit only ball bearings in the gear case. Then the possibilities of wear and of changing center distances need not be considered, especially if the gears can be fitted in place with the proper clearance. (Note: Sunbeam fits even the crankshaft gear in plain bearings.)

The crankshafts of most of the engines fitted with gears ran in plain bearings which might wear. This was especially the case with engines having six-throw crankshafts. If a bearing ran hot, probably the centerline of the crankshaft after the engine had been overhauled had another position than originally, unless special means to prevent it were provided. Consequently in the Renault, Peugeot, Napier and similar engines ball bearings were used for the crankshaft and in this manner the difficulties resulting from possible change of center distances were avoided. In the Hispano-Suiza engine only the first crankshaft bearing—which also takes the gear pressure—is a ball bearing. At each overhaul the slightly worn plain bearings must be replaced by new ones truly centered.

If it is not desired to go to these measures it is necessary to fit a joint either in the fixed part—for instance, between crank case and gear case (Fig. 24)—or in the transmission between crankshaft and gear (Figs. 25 and 27), which will either adjust itself automatically while running or can be adjusted in assembly. If such a joint adjusts itself automatically, as must be the case when it is fitted between crankshaft and gear, it also equalizes the expansions due to heating of the crank case and gear case and makes the assembly of gear and engine easier. Generally two shafts—or two housings—which are to remain always parallel can be connected by a sliding cross linkage K (Fig. 25), a sort of sliding joint S (Fig. 24), or a floating shaft W (Fig. 26).

The method of the sliding cross linkage has been used in the Rolls-Royce gear—however, in a fixed housing—in a notable manner. The link (Fig. 22) and e of Fig 21 lies between the outer engine housing and the intermediate gear wheel, d, which is held in the housing. Consequently this can adjust itself and always remain concentric with the crankshaft. The whole set of planetary gears also always remains concentric with the crankshaft—which may shift in the casing—but not with the casing. The joint between the fixed gear wheel and the housing is accordingly adjustable transversely in any direction and adjusts itself correctly while the forward bearing g and h must be adjusted on each overhaul of the engine by the adjusting screws f.

In principle this cross link could just as well be placed between crankshaft and gear. In that case, however, the whole gear would have to be carried in rigid bearings in the case. The preceding arrangement saves a bearing and has the advantage that the cross link does not rotate and consequently can be easily kept in oil. Besides, it does not have to transmit the varying torque of the crankshaft. In addition, the mass of the internal gear which is directly attached to the crankshaft helps the smoothness of running.

For the rest, the problem of making the joint in the housing adjustable is best solved either by fitting the gear housing with a flange which is not concentric on the engine housing and which after every overhaul can be adjusted and secured anew, or by making the bearings adjustable (Fig. 27). This new arrangement of the Rolls-Royce gear is known only from patent drawings. In it the upper gear can be adjusted by eccentrically set ball bearing cages, c and d, and the lower gear can be adjusted on the engine shaft by means of adjusting screws. The joint between crankshaft and gear wheel a is a universal one, which is very convenient for assembly.

A gear made by the Friedrichshafen gear factory (Zahnraderfabrik Friedrichshafen) illustrates a method by which the crankshaft can be separated from the rigid gear set (Fig. 28). At the same time it accomplishes the attachment of large rotating masses to the crankshaft, so as to avoid reversals of pressure, and the separation of the irregularities of the crankshaft from the gear. The utility of this type of construction depends principally on the suitability of the type of coupling used.

When long shafts are used between engine and propeller it is best to fit the joints which have been proven by use in automobiles.

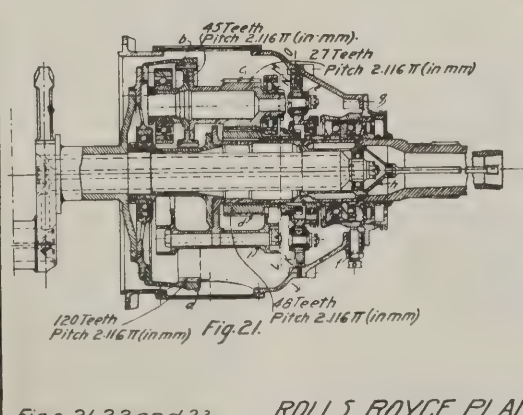


Fig. 21.

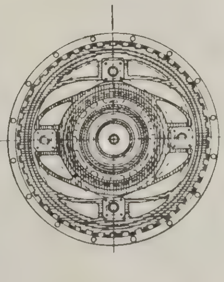


Fig. 22.

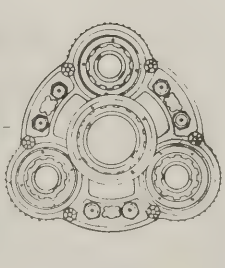


Fig. 23.

Section on J.K.L.M.N.O.

Figs. 21, 22 and 23 ROLLS ROYCE PLANETARY GEAR 3142-11

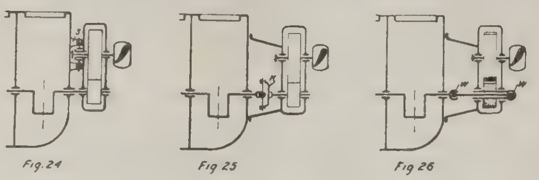


Fig.24 Fig 25 Fig 26

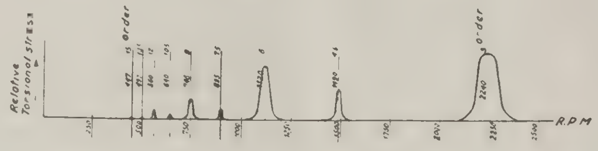


Fig 35 Dependence of the torsional stress on the speed of rotation

Figs.24,25,26&35. 3142-11

Spring or elastic joints have the advantage that they need no lubrication. They must, however, be absolutely so perfect that their elastic distortion compared to the angular motion allowed is either extremely small or accurately determinate that their influence on the vibration frequency of the shaft can be determined by experiment or computed. Otherwise they may cause great danger to the security of the gear and engine as a result of the possibility of resonance vibrations.

III. Primary Vibrations in the Shaft Transmission.

The primary vibration frequency of a freely vibrating crankshaft, resulting from some passing impulse, is determined partly by the masses involved—that is, the propeller, the pistons, cranks, counter-weights and gears—and partly by the springing of the shafts and gears. In the usual German six-cylinder engines, with moderately heavy air propellers, whose moment of gyration lies between 20 and 60 kg/m² the freely vibrating shaft has a frequency of about 6,000 vibrations per minute; in four-cylinder engines more, and in the single crank radial or revolving, about 20,000. Indeed, freely vibrating six-throw shafts make a greater number of vibrations than the figure given, because with the masses distributed on the cranks they can vibrate in two or more nodes instead of one. However, these higher frequencies need never be practically considered.

3142-11.

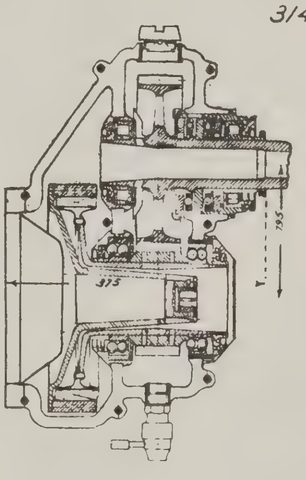


Fig.28 (The Friedrichshafen Gear Factory Gear.)

Figs.27-28.

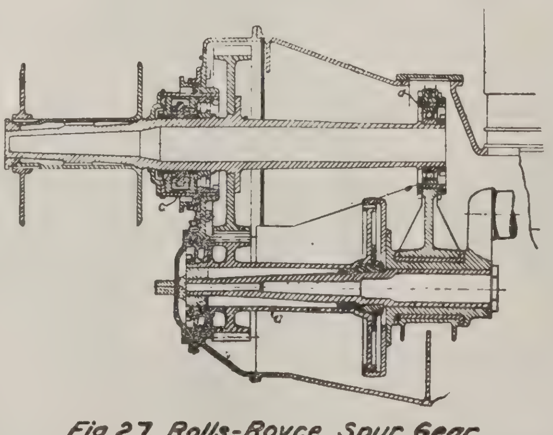
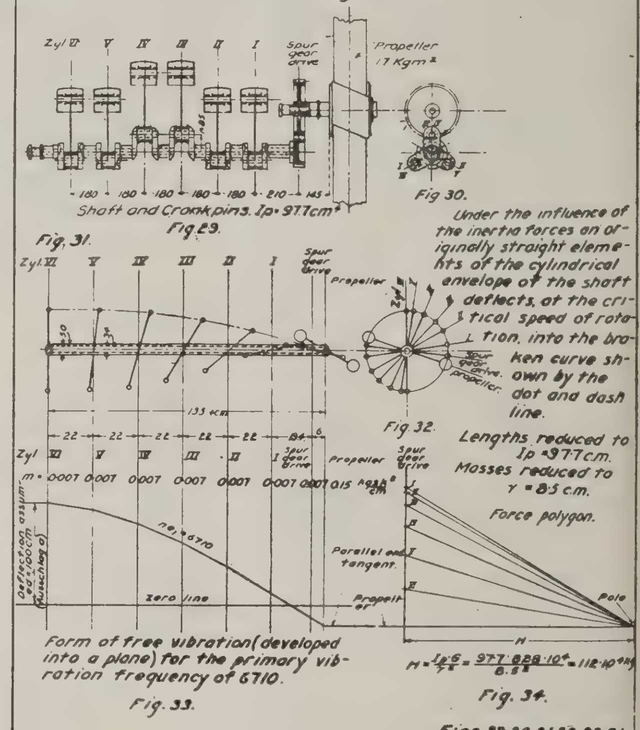


Fig.27. Rolls-Royce Spur Gear.

Various methods can be used for the computation of the vibration frequency; for instance, that of Gümbel or that of Kutzbach. (For the former, see "Zeitschrift des Vereines deutscher Ingenieure," 1912; for the latter, the same—1917.) They can be measured in operation by the use of the Geiger[3] Torsiograph made by Lehman & Michaelis of Hamburg—which requires a degree of practice in its application—or with the engine stopped. For this a series of light blows at regular intervals is applied to the crankshaft. The vibrations thereby excited in the shaft increase markedly when the frequency of the blows coincides with the frequency of primary vibration of the shaft. (When gears are used contact under pressure must be maintained by suitable springs between propeller and crankshaft.) The primary vibration frequency of the crankshaft is of great importance, since in operation a resonant effect from the power impulses of the engine itself absolutely must be avoided. In a six-cylinder four-cycle engine or a three-cylinder two-cycle engine there occur regular impulses with frequencies of the threefold, sixfold, ninefold, etc., revolutions, of which the first are the strongest. In an eight-cylinder four-cycle engine or a four-cylinder two-cycle engine the impulses occur at 2, 4, 6, etc., multiples of the revolutions. Consequently, for a six-cylinder engine whose crankshaft has a vibration frequency of 6,000 per minute the most dangerous speed of revolutions is 6,000 ÷ 3 or 2,000 r.p.m. The next most dangerous is at 6,000 ÷ 6 = 1,000 r.p.m., etc. It is important that the revolutions ordinarily used shall lie as far as possible from the region of resonance.

Figs 29 to 35 Computation of the torsional primary vibration frequency of an aircraft engine. 3142-11



Under the influence of the inertia forces an originally straight elements of the cylindrical envelope of the shaft deflects, at the critical speed of rotation, into the broken curve shown by the dot and dash line.

Form of free vibration (developed into a plane) for the primary vibration frequency of 6710.

Fig. 33.

Figs. 29,30,31,32,33,34

If the diagrams of the individual cylinders are not equal, that is, if, for instance, in an engine with two carburetors, one-half the engine is regularly delivering more power than the other, then not only are the three- and sixfold revolution frequencies, impulse frequencies, but also the four and one-half and ninefold revolution frequencies. Thus 6,000 ÷ 4½ = 1,444 r.p.m. may be dangerous. It is therefore always advisable to keep the primary vibration frequency of the crankshaft of six-cylinder engines above 6,000.

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(3) See Z.V.d.E. 1917.

Different builders use elastic couplings between the air propeller masses and the gear masses to improve the uniformity of rotation and protect the gears from torsion. But by that the elasticity increases and the vibration frequency decreases markedly. In a six-cylinder engine, for instance, it would be extraordinarily dangerous if the vibration frequency dropped to $3 \times 1{,}400 = 4{,}200$, on account of the use of such a coupling. The shaft revolving at 1,400 r.p.m. would break sooner or later. Likewise the gear would have no endurance.

If it is desired or is necessary to use such a coupling it must either be made so unyielding that the vibration frequency will always remain high enough or it must be made so yielding that the primary vibration frequency will not be reached at any ordinary speed, and, if possible, not at idling speed. In any case such couplings should be carefully studied out, and for safety's sake it should be established that the degree of elasticity in the coupling as actually constructed agrees with that assumed in the computations. Otherwise an endeavor should be made to get along without elastic members.

This question is also of importance in connection with fast running blowers whose masses completely change the vibration frequency of the shafts. For a ratio i the moment of gyration of the blower has an effect on the free vibrations of the i^2 value.

In Figs. 29 to 34 (based on a communication from the Maschinenfabrik Augsburg-Nurnberg, Augsburg) the vibration frequency of the first degree (primary vibration) of an aeroplane engine and reduction gear is determined graphically. It is assumed that the propeller can be considered as a rigid mass and the gear wheels in actual contact, which is not exactly true. The computation—in which the crankshaft is replaced by a smooth plain shaft of the same value relative to elastic distortion—shows that the primary vibration frequency of the system, consisting of the six driving masses with crankshaft, reduction gear and a certain air propeller, lies at about 6,710.

Fig. 35 shows approximately the influence of the different irregular impulses of the motor torque in the way of exciting resonance if the crankshaft with a primary vibration frequency of 6,710 makes successively from 0 to 2,500 r.p.m. It is based on results from the Torsiograph. It can be plainly seen that between 1,600 and 2,000 r.p.m. the engine is fairly free from critical speeds of rotation and that consequently within this range the gear wheels will be little stressed from vibrations. The critical r.p.m. at $n = 1{,}490$ is only the result of unequal work by the different cylinders, consequently is avoidable and works differently in different cases.

STRUCTURAL ANALYSIS AND DESIGN OF AEROPLANES

A Review of a Noteworthy Book by B. C. Boulton, in Charge of Stress Analysis and Structural Design, McCook Field

Assisted by A. S. Niles, Stress Analysis Branch, McCook Field

THE publication by the Engineering Division of the Air Service of this book marks a new epoch in aeroplane structural design. It is tangible evidence of the great advance that has been made in this country during the last three years, for our entire system of aeroplane structural analysis has been developed within that time.

On first examining this book, the reader is struck by its general appearance. As a piece of book-making and as an example of careful planning and attention to typographical details, the book deserves study. Few prefaces to modern textbooks are as illuminating as the foreword to this book, which not only contains a brief summary of the subject matter, but states the general method of attack that is to be followed and emphasizes certain important principles of design. The futility of attempting to economize on the structural engineering on an aeroplane is forcefully suggested. From the table of contents, an idea can be very quickly obtained of the subjects treated. The book is divided into eight chapters and an appendix. The chapters is turn are divided into articles each of which treats of a complete sub-division of the chapter. The manner in which the title of the chapter is given on each left hand page, and the title of the article under discussion together with its number, on the right hand page, is of great assistance in using the book. The complete index makes the finding of even minor subjects very easy. With few exceptions, the photographic illustrations are not only clear but unusually instructive. The neatness and uniformity of the drawings reflects a great deal of credit on the tracer. For a book of this character the number of typographical errors is surprisingly small, which is a tribute to the painstaking proof reading. It is a pleasure in reading this book to find illustrations and tables, with but few exceptions, directly with the text to which they belong. In a volume containing so many drawings and tables securing such an arrangement was no inconsiderable task.

Upon closer study one is struck with the comprehensiveness of the book. Consideration is given to aerodynamics in so far as it concerns structural design, and to the latter subject a good deal of attention is paid, besides treating of the stress analysis of each of the important parts of an aeroplane. The book is both wide in scope and thorough. Some important subjects, such as chassis analysis, which are scarcely mentioned in the few existing texts on aeroplane structures, are gone into exhaustively. One of the most valuable features of this book is the manner in which the application of the principles of analysis is everywhere illustrated in detail by numerical examples. Frequently such examples are of so elementary a character that they afford but slight assistance in the solution of practical problems. In this book, however, the methods are illustrated by analysis of the various parts of actual service aeroplanes. It is refreshing to find that the faithful JN is not the aeroplane chosen. Another important characteristic of the book is its simplicity and its consistent avoidance of difficult mathematics. No knowledge of calculus is necessary to apply practically all the methods given, though elementary calculus is needed to fully understand many of them. The style, in general, is clear and simple. Some of the more difficult ideas require a rereading to grasp fully.

The first chapter makes a bold and rather successful attempt to state clearly all the fundamentals of both applied mechanics and strength of materials. Such a chapter is of particular value to an engineer who has been out of touch with theoretical work and wishes to review the principles quickly. The chapter opens with a statement of the fundamental equations of equilibrium. Then follows a presentation of the various analytical methods for the solution of a truss as well as the standard graphical solution. This is followed by a simple presentation of the beam theory and the methods for calculating moments and next, the application of the three-moment equation is very clearly given. Closing the chapter comes a brief discussion of combined loading, columns, wood and steel in combination, and torsion. The different subjects are not given in a sketchy manner, as would seem almost necessary because of the brevity of the treatment, but are illustrated in detail by examples.

Chapter II deals with a number of general subjects. The more important articles in the first portion of it are those on structural design for maximum visibility, choice of wing sections, characteristics of military aeroplanes, weight analysis of aeroplanes, and location of interplane struts. Under choice of wing sections is given a discussion of suitable criteria to use in selecting aerofoils, the principal properties of some forty aerofoils tested at the Massachusetts Institute of Technology. Complete characteristics and ordinates are given for the six aerofoils selected as the best. The types of aeroplanes to which these sections are best adapted are suggested in a table. In two tables accurate figures for the characteristics and weights of the various parts of a number of both foreign and American aeroplanes are shown. These are of great assistance to designers. The table giving the most economical location of interplane struts for monoplanes, and for one, two and three-bay biplanes, is the most complete treatise on the subject published and is a real contribution to aeroplane structural engineering. The latter part of this chapter is devoted to a discussion of loads coming on aeroplane wings and then distribution under different flight conditions. Ideas on this subject are not yet fixed as much experimental work remains to be done, but the latest thought on this subject is simply and clearly presented. The discussion of diving, though as good or better than can be found in any text at present, yet is not satisfactory. Sufficient differentiation is not made between small and large aeroplanes and the latter would be too heavily stressed. Only pursuit types would be likely to dive at limiting velocity which is the condition assumed for all types. This discussion is followed by a statement of the general methods employed in the usual wing analysis.

In Chapter III the detailed application of these methods is given, the wing cellule of the V. E. 7 being chosen as an example. No mention is made of the British Perry method which is supposed to give an exact solution. The principles outlined in the present book are much less laborious and much easier to understand than those advocated by the British. Yet for certain cases where the spar compressions are large and the slenderness ratio of the spar great, the simple method is inadequate. The last article in Chapter II suggests a comparatively simple and ingenious method for solving such a case. It is correct for the illustration given, but is inaccurate, though on the safe side for spars continuous over one or more supports. From the theoretical rather than the practical point of view the omission of an exact solution for the problem of combined stresses is a serious one. The treatment of stresses due to eccentric strut loads and wire pulls is good. An unusual article is that on multispar construction. The solution offered, while frankly approximate, is very reasonable and should give satisfactory results. In connection with this chapter it may be noted that no methods are taken up for the solution of stresses in incidence or external drag wires. Their effect on the rest of the structure is for the most part neglected.

Chapter IV deals with miscellaneous problems of design. The design of both ribs and struts is well discussed. The types of rib construction given are the result of much experimental work done during the past two years. The problem of attaching the ribs and spars is gone into thoroughly. The formulas and charts for calculating the properties of solid and hollow struts are new and very convenient. In all designs the streamline section described should be used. Tables showing standard practice in the design of incidence and center section cross wires should be useful. The correct methods for splicing spars or longerons and the best types of built up spars are given.

Chassis analysis which forms the subject matter of Chapter V is ably treated. Here especially is evidence of a careful development in theory. It is practically the only real article on the subject. The objection may be raised that it is not worth while to go into an elaborate chassis analysis, but especially in the case of chassis, secondary moments are all important and an approximate analysis on the basis of direct stresses is misleading. The article dealing with shock absorbers is of special interest and will do much to inform designers on this subject.

In Chapter VI is given a detailed analysis of control systems. So frequently these are designed solely by judgment, with result that static tests reveal many failures and weaknesses. Diagrams are given showing the functioning of several types of control systems. Under the heading "Relation of Controls to Pilot", is given a table showing average dimensions for a number of one and two-place aeroplanes. Such a table makes possible the design of a standard cockpit which is so necessary. An interesting example of a sprocket type of aileron control is shown in a drawing and briefly described.

Chapter VII on control surfaces is mainly descriptive. A table is included giving practically complete data on some thirty types of tail surfaces which have been sand-tested at McCook Field. Several principles in the structural design of control surfaces are discussed and illustrated by photographs and drawings. Interesting details of various types of hinges are described. A brief treatment is given of the analysis of control surfaces.

One of the more important chapters in the book is Chapter VIII, which deals with fuselage analysis. There is comparatively little new material in this chapter but the stress analysis of the truss fuselage that is given is very carefully worked out. The ordinary manner in which the computations for the panel loads and the different conditions of loading are presented deserves careful attention. No consideration is given to the problem of obtaining the stresses produced by torque from the rudder load. As these are not especially important, the concentration of effort on the main stresses is probably advisable. No real solution is offered to the problem of designing the longerons after the direct stresses have been calculated. The question involved here is the determination of the proper "fixity coefficients" for the longerons which are designed as columns. No account is taken of the effect of inertia loads in reducing stresses. Because of the uncertainty of our knowledge of these loads, the conservative stand adopted by the authors is well taken.

Some of the most useful material in the book appears in the appendix. The first article, on the calculation of the high speed of aeroplanes, is very good indeed. Following that is a table of strength factors required with different types of aeroplanes for the wings, fuselage and control surfaces. Though these are for military aeroplanes they may be readily used for the corresponding commercial types. The three-moment equations and deflection formulas for continuous beams with various types of loading are a useful and original piece of work. The remaining article is a comprehensive treatment of the strength properties of aeroplane woods. The last portion of the appendix is devoted to a number of valuable tables and charts, none of which are readily available elsewhere. The charts for the calculation of wood, steel and duralumin columns are of special interest.

The Engineering Division is preparing a second edition of one thousand copies of this book principally for use as textbooks. A number of errors discovered in the first edition have been corrected. In its final form this book should be standard for many years.

The reader will notice that several of the more important articles in the book have been published during the past in AERIAL AGE.

(*Concluded from page* 459)

as the Aeromarine F.-5-L. Navy Cruiser was known, flew from New York to Southampton, L. I., on July 30th, with fourteen passengers, a distance of 110 miles, in 72 minutes. Two Junker monoplanes which left New York July 29th arrived in San Francisco August 8th. A Gallaudet Liberty Tourist biplane flew a special edition of the New York *Evening Post* from New York to the Roosevelt notification ceremonies at Hyde Park.

On August 12th Lieut. A. G. Hamilton made a world's record parachute drop, jumping from a plane 20,900 feet in the air over Carlstrom Field, Fla. He reached the ground in twelve minutes.

On August 13th Miss Laura Bromwell broke the world's loop-the-loop record for women at Curtiss Field, Garden City, L. I., looping eighty-seven times in a Curtiss Standard biplane.

On September 5th the U. S. Army Air Service conducted successful experiments with the pitched propeller, stopping planes within seventy-five feet of where the wheels first touched the ground. The same month Californian canneries employed seaplanes in locating schools of fish, reporting larger catches at less cost of time and money.

The New York-San Francisco Air Mail system was opened September 8th. The continued use of aircraft for commercial purposes led the American Legion at its national convention in Cleveland, O., September 28th, to adopt a resolution urging Congress to enact laws regulating aerial transport.

The Gordon Bennett Aeroplane Race was held at Etampes, near Paris, on September 27th. On September 28th an airplane piloted by Paul Collins demonstrated fireproof paint at Curtiss Field, L. I. Air Service officials saw the plane set afire in mid air and fly unharmed until the gasoline, which had been poured over it had burned away. The L. W. F. "Giant" three Liberty-motored bomber, America's largest airplane was accepted by the Army Air Service after trials at Mitchel Field, L. I., September 29th.

On October 21st a group of British scientists sailed from Norfolk, Va., for the Antarctic regions. They carried an airplane with which it is planned to survey the west coast of the Woodell Sea and Graham Land. On October 23rd the "Santa Maria" and "Pinta," Aeromarine flying cruisers, flew from New York to Key West to enter a passenger and mail service between Key West and Havana, Cuba.

On October 28th a Curtiss single-motored Eagle "Aerial Pullman" flew over New York City with nine men and women aboard.

After a series of experiments the U. S. Navy on November 10th announced that the radio telephone could be used from aircraft to landing stations up to a distance of 300 miles.

On November 11th it was announced that the Royal Canadian Mounted Police would in future use aeroplanes and flying boats extensively for outpost duty. Two American Standard Wright machines flew from Nebraska to Mexico City to attend the inauguration of the Mexican president. On November 21st the Goodyear Company established a dirigible passenger service between Los Angeles and Catalina, California.

On Thanksgiving Day more than thirty aeroplanes raced over a 132-mile course at Mitchel Field, L. I., for the Pulitzer Trophy. On November 30th the National Aircraft Underwriters Association at its annual meeting adopted a resolution recognizing the increasing popularity of aircraft and urging the need of federal air laws.

Early in December, Pilots Smith and Christenson set a new record for the Air Mail, flying 16,000 letters from Chicago to New York in five hours and fifty-six minutes.

Through the operation in 1920 of a few aircraft lent to the Forestry Service by the Army, approximately $35,000,000 worth of timber was saved from destruction by fire, more than the total Army Air Service appropriation for the fiscal year. About 1,000 fires were reported.

The Wright Aeronautical Corporation of Paterson, N. J., produced a cannon motor discharging 1½" shells through the propeller shaft of an airplane in flight.

A Curtiss Seagull flying boat made a 1,100-mile demonstration flight to all the principal islands in the Philippines carrying mail, passengers and merchandise.

NAVAL and MILITARY AERONAUTICS

Permanent Commissions for N. R. F. C.

In May, 1921, examinations will be held in the Navy for the transfer to appointments in permanent ranks in the Navy of officers holding temporary commissions and members of the Naval Reserve Force. The number of officers so transferred will not exceed 1,200 officers of the line, of which number 500 may be appointed from Class 5, Naval Reserve Flying Corps.

Members of the Naval Reserve Force with commissioned ranks who are not more than 35 years of age, or whose age is not greater than 35 years plus their total former naval service, who qualify by the required examination are eligible for transfer to the permanent commissioned line of the Navy.

The examination will be divided into several general subjects and in the case of examinations for aviation duty, questions on aviation will be substituted for one of these subjects. A knowledge of aviation will, therefore, be of considerable assistance in the examination for aviation duties. It is interesting to note that officers' records will count 200 per cent more than any other subject.

One hundred and thirty-two Naval Reserve officers, Class 5, have applied to take this examination. One hundred and three of this number are on active duty and thirty-two on inactive duty. The Navy Department has sent letters to all Class 5 Aviation officers who are on inactive duty enclosing examination application blanks.

Army Ordnance Association

There has recently been issued the first number of *Army Ordnance,* official publication of the Army Ordnance Association, Munsey Building, Washington, D. C. The magazine is attractive typographically, is handsomely illustrated on good paper, and contains authoritative and interesting articles by General Crozier, Col. J. H. Burns, Col. Harry B. Jordan and others. The officers of the Association are: Benedict Crowell, president; William W. Coleman, vice-president; Ralph Crews, counsel; Charles Elliott Warren, treasurer; James L. Walsh, secretary and editor; Samuel McRoberts, Guy E. Tripp, Waldo C. Bryant, Robert P. Lamont, Frank A. Scott, C. L. Harrison, directors. Capt. Henry Erwin is business manager.

Coast-to-Coast Flight in 24 Hours Planned

San Antonio.—An attempt to fly 2,079 miles from Florida to California in an aeroplane in twenty-four hours will be made February 22 by Lieutenant Alexander Pearson, Jr., Major Henry C. Pratt, air officer of the 8th Corps area, announced Lieutenant Pearson won the transcontinental air race last winter.

The flight will be made in three "hops." The starting point will be Pablo Beach, Jacksonville, Fla. The first hop of 804 miles, will be made to Ellington Field, Houston, Tex.; the second from Ellington Field to El Paso, a distance of 660 miles, and the third is scheduled from El Paso to Rockwell Field, San Diego, Calif., 615 miles.

The flight will be the first attempt to cross the continent for a continuous speed record, the two necessary stops only requiring forty-five minutes.

Experiments in Apparatus for Handling Gas

The experimental station at Fort Omaha is conducting experiments in apparatus for the handling and manufacture of hydrogen gas for balloons. This work is of importance because, with the coming of large dirigibles and the general expansion of the lighter-than-air branch of the service great quantities of this gas at a reasonable price are necessary. Proper equipment for handling the gas insures safety and economy in its use.

The gas used in balloons is frequently stored in cylinders under the high pressure of 2,000 pounds per square inch. Under this high pressure it is difficult to get valves to work smoothly and easily and still be tight in service preventing gas losses from leakage. At this experimental station such valves have recently been designed. Like other good pieces of mechanism, they are comparatively simple in design, and they can be made much more cheaply than the more complicated valves previously in use. In addition they have been especially designed to meet air service demands which require a valve that will vent a cylinder rapidly without freezing up. The standard valve now in use requires seven minutes to completely vent a cylinder, while the present valve developed at Fort Omaha will accomplish this in from 25 to 50 seconds.

Fort Omaha is being equipped with a machine shop which will be suitable for the manufacture on the working scale of much of the machinery being designed there. One of the first pieces of apparatus which will be manufactured in this shop is a hydrogen gas generator known as a silicol generator because of the fact that, in its operation, the hydrogen is produced by mixing ferro-silicon and caustic soda. In this generator are embodied the results of wide experience gained in operation of this type of equipment during the war. Such improvements have been made that the new generator will produce almost twice as much hydrogen from a given quantity of materials as did the older types. At the same time, a generator of a given size will have almost double the capacity of former machines. These improvements will result in great economies and in the production of a machine highly specialized and designed to meet the exacting demands of military field service.

Furthermore, there is ready for test at this station an improved type of electrolytic cell for the production of hydrogen gas. The design of apparatus of this kind requires highly developed technical skill. This particular apparatus, like the silicol generators already developed, is expected to produce many times more gas for a unit of given size than does apparatus of the same type now in use. In present apparatus, a good deal of trouble is experienced with insulation; in the newer design, this will probably be avoided altogether, or at least greatly reduced. The decomposition of water by the electric current is a long established process but, like most similar processes, is susceptible of a good deal of development in the hands of trained engineers. It is an indication of the general progressiveness of the Omaha station, and the air service in general, that technical problems of this kind are being undertaken and that the highest development and the greatest efficiency are the things constantly sought after.

Aviation Depot to Be Expanded

Further expansion of the government aviation repair depot located near the city of Montgomery, to include the supply department now maintained at Souther Field, Americus, Georgia, is indicated in a statement made here by Major W. R. Fitzmaurice, commandant of the depot, to chamber of commerce officials, in seeking ways and means for extending the paved street to the big plant.

An inspector has been sent to the Montgomery plant, it was stated, and communications received from the war department, while not binding, indicated that the proposed consolidation of the two big aviation depots was being seriously considered, and it was pointed out that better facilities for reaching the local shops would have a bearing on a final decision.

Pensacola Notes

In General: Two hundred, seventeen (217) flights were flown in heavier-than-air craft for a total of one hundred eighty-four hours and thirty minutes (184:30).

Rain and squalls retarded flight operations on Tuesday, December 1, 1920.

The following long distance flights were made December 3 and 5, 1920:

F-5-L No. 4009 to Mobile, Ala. and return, December 3, 1920.

F-5-L No. 3669 to Mobile, Ala. and return, December 5, 1920.

Squadron 1: (N-9's) Flying time, 55:30; average number of planes available, 15.

Squadron 2: (HS-2's) Flying time, 34:05; average number of planes available, 5.

Squadron 3: (H-16's and F-5-L's) Flying time, 86:30; average number of planes available, 6.

Squadron 4: (R-6-L's) Flying time, 81:25; average number of planes available, 7.

Number of enlistments during the week as follows:

General Service Ratings	2
Permanent enlisted personnel:	
Heavier-Than-Air Department	289
Lighter-Than-Air Department	178
Gunnery Department	61
Operations Division	108
Medical Department	17
Disbursing Department	36
Special Details (Personnel Officer)	93
Eagle No. 43	30
Eagle No. 53	31
Students under instruction (Enlisted)	35
Students under instruction (Marines)	12
Argentine Petty Officers under instruction	10
Total enlisted complement	895

FOREIGN NEWS

Civil Aviation in Australia

"The Federal Government's appointment of a Director of Civil Aviation has attracted renewed interest in aviation in Australia," reports the *Daily Telegraph* correspondent in Sydney. "By the arrival at Perth of Degaris on a flight from Melbourne in the DH-9 machine the pilot (Lieut. Briggs) indicated Trancontinental possibilities. The flying time was 18 hours 12 minutes, and the distance 2,169 miles. The route taken was via Mildura, the Murray River Valley, Adelaide, over the Transcontinental Railway. The first machine to cross the great Nullarbor Plain left Melbourne on the morning of November 30, and arrived at Perth on December 2 at midday. Degaris, who is a Victorian business man, desired to demonstrate the commercial utility of aviation. Aeroplanes are now frequently used in New South Wales for communication between the country and the town. A machine flew on December 2 in fast time from Sydney to Bathurst, across the Blue Mountains. The new Federal Department should stimulate the movement for connecting remote parts of the continent by air."

A Zurich-Munich Service

The request of the Ad Astra concern to the Swiss Federal Air Department for a concession for an aerial service between Zurich and Munich has aroused some controversy locally. One party urges the Government to be more prudent before subsidizing such a service, while the other side wants to see a network of aerial routes organized and running from a Swiss center.

Germany's Aircraft

A Reuter's message from Berlin states that Air-Commodore Masterman, the president of the Inter-Allied Aeronautical Commission in Berlin, notified the German Government on November 16 that the Ambassadors' Conference decided on November 3 to consider the Spa protocol of July 12 as annulled, and the Boulogne decision of July 27 as being still in force. The Boulogne decision prohibits the manufacture and importation of aeronautical material until three months after Article 202 of the Peace Treaty has been carried out.

[Article 202 of the Peace Treaty provides that, on coming into force of the Treaty, all German military and naval aeronautical material, except the machines mentioned in the second and third paragraphs of Article 198, must be delivered to the Governments of the principal Allied and Associated Powers. Delivery must be effected at such places as the said Governments may select, and must be completed within three months]

As a result of the action taken by the Allies, shipments of German-made aeroplanes intended for the United States and South America have been stopped and foreign orders are being cancelled. In view of the fact that hidden aeroplanes and aviation material are still being discovered in various parts of Germany by the inter-Allied Commission many months may elapse before the building and export of German flying machines is permitted by the Allies.

Handley Page Records

Continental Air Services (in conjunction with Cie. Messageries Aériennes), September 2, 1919-November 27, 1920.

Passengers carried (exclusive of mechanics)	4,139
Freight carried	212,617 lbs.
Mileage covered	319,790 miles

Extension of German Air Mails

The daily air mail between Berlin and Gelsenkirchen is now linked up with the important manufacturing districts within a 20-mile radius of Essen by means of a regular service of motor cycles to which the local mails and parcels are transferred from the aeroplane by the postal authorities on arrival at the terminal aerodrome. The air mail leaves Berlin at 10 a. m. daily and Essen is reached in 2¾ hours as compared with 10 hours by rail. The German Air Ministry are endeavoring to make arrangements for the establishment of an airport at Cologne with a view to linking up that city with direct air services to Paris and London. A regular daily air service has also been decided upon between Königsberg, Munich and Riga for the carriage of passengers and freight. Trial trips have already been made, the whole distance being covered by aeroplane in five hours as compared with three days by the present rail service. The regular air mails will begin next spring. It is also stated that the German authorities have contracted with the Bayerische Rumplerwerke A.G. for a regular daily air mail service between Augsburg, Munich, and Frankfort-on-the-Main. The capital of the company has been increased from M.1,000,000 to M.2,500,000.

French Regulations Issued

The new code of regulations issued in France by the Under-Secretariat for Aeronautics is most complete and shows conclusively the trend toward the development of commercial aviation by government recognition of the industry and the establishing of laws for minimizing the risks. The regulations cover many topics, as air material, personnel, landing-places, wireless communications, etc. Government testing of all material will be strictly enforced. A manufacturer wishing to construct a new machine will be required to submit his plans to the technical section of the Air Department. After the plans have been approved, the construction of the machine is supervised, and trials must take place under the direction of a government representative. Should the tests prove the machine to be reliable, the manufacturers will receive a "certificate de navigabilite" and a "certificat d'immatriculation."

Armed with these certificates, he must make application to the National Aeronautical Society for a tag bearing a distinguishing group of letters, arranged much on the same system as motor-car numbers, as many as 16,000 combinations having been arranged for this purpose. The letter "F" showing that all machines are registered in France, precedes every combination. By this system of tags the aerial navigation service is enabled to know at once the registered number of every aeroplane, its owner, the port of registry, the date of its construction, and its history, including repairs, etc. The regulations provide for an inspection of a plane by qualified inspectors after each 100 hours of flight, with a full report entered on the books of the port of registry. Any damage or mishaps, however slight, must be reported, and the machine must be examined by an inspector after it has been repaired.

According to the "Auto," up to September, 1920, there had been issued 350 certificats d'immatriculation. That is to say, on that date there were 350 machines for public aerial transport as against 100 reported in July.

In view of the very considerable increase in aerial passenger and freight service, permits to pilots will, in future, be of three kinds: (1) tourist pilot's permit; (2) public transport pilot's permit; (3) navigator's permit.

A tourist's permit will be issued to a pilot flying for his own pleasure, and not carrying paying passengers or freight. Ample proof of skill in the air will be required before the permit is issued. In order to obtain a public transport pilot's permit, it will first be necessary to hold a tourist's permit, but the test goes a great deal farther, requiring a written examination, and including night flying as well as a thorough knowledge of all the rules of the air.

The navigator's permit will be of two classes, first and second. The first class is for navigators accompanying pilots on long distance flights; the second class is for short distance flights when the pilot acts as his own navigator. Mechanics belonging to the navigating personnel will be required to pass an examination before they are permitted to fly.

Age limits have been fixed for all of these permits: a tourist permit may be granted at the age of 18; a mechanic's permit at the age of 19, while 21 is the lowest age at which the other permits may be obtained.

A very severe medical examination, repeated every six months will, of course, be required of all applicants, and different permits will be issued for aeroplanes and for seaplanes.

These regulations have been drawn up in an earnest endeavor to encourage and facilitate aerial activities, and at the same time, to reduce to a minimum the risk incurred by the general public in making use of air transportation.

France Seeks Fliers To Guard Her Future

Paris.—Although Marshals Foch, Joffre and Petain have declared they do not fear German military invasion of France for many years to come, it is evident that this does not include the possibility of Germany developing a mighty aerial force as the basis of "a war of vengeance" such as was predicted by Andre Lefevre, who resigned the portfolio of Minister of War last week, and his partisans. M. Lefevre's theory is that France requires an enormous standing army as long as Germany is not entirely disarmed.

Not only have arrangements been made to strengthen the aviation branches of the French regular forces but newspapers issue an appeal for volunteers for a new aviation guard which will give France better protection in case Germany's aviation industry is restored to such a point that it will constitute a real menace to the Allies.

The new corps, which will be trained by regular French air officers, will be open to any one under 55 years old whose vision is good and who has fulfilled all his military obligations. At stated intervals the corps will undergo training at the State's expense, although volunteers will have a right to resign from the corps at any time they wish except in case of a state of war, when they will be expected to join on short notice the units to which they have been assigned.

Volunteers will not only act as observers but will be urged to take up intensive courses of training in connection with anti-aerial machine guns, camouflage and the projection of strong light cones and gas clouds.

Japan's Share of German Aircraft

Japan is to receive about 50 machines of recent design, seized in Germany by the Inter-Allied Commission. A considerable sum has been voted by the Japanese Government for the construction of hangars at the military aerodromes of Tokorozawa and Kagamigahora; and two airship sheds at Juterbog, near Berlin, are to be taken down, sent to Japan and re-erected with the aid of German engineers. Japan is also expecting to receive one of the Zepplins at Seddin, Pomerania. Thirty British Naval aviators are being loaned by the British authorities to instruct Japanese naval officers in science of aeronautics and aircraft construction. They will report in Japan in the spring of 1921.

Aeroplanes in Forestry

Toronto—The use of hydroplanes and aeroplanes in modern Canadian forestry was one of the subjects discussed at the fall meeting of the Woodlands Section of the Canadian Pulp and Paper Association, held at the King Edward Hotel, on Wednesday and Thursday, December 8 and 9. The Laurentide Company Limited, of Grand Mere, Price Bros. and Company, of Quebec, and the Spanish River Pulp and Paper Mills, of Sault Ste. Marie, Ont., are all employing aerial machines in fire patrol and photography work, and their operatives contributed to the discussion.

Geologists by Air Route

Ottawa—If plans under consideration by the Dominion Air Board are matured, Canadian geologists who every summer make arduous trips to far northern regions to carry on field work, will next summer be spared much effort and saved several weeks of valuable time by being carried in aeroplanes. The first attempt to utilize the flying machines for this practical purpose will be made in the Mackenzie river basin, and the flight will probably be from Peace River Landing, in Northern Alberta, to Fort Norman. The first man to advocate the air route for geologists was Dr. Alfred Thompson, member for the Yukon, who discussed the time-saving possibilities of this plan in the House of Commons two years ago.

Farming in Queensland

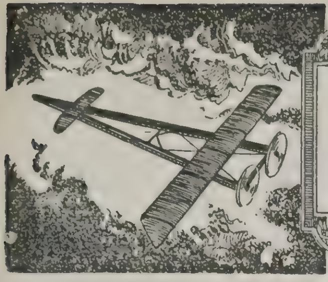
The prediction that aeroplanes would be largely availed of by owners of agricultural and pastoral properties in the western districts of Queensland, is already coming true. A station owner, Mr. T. Behan, of Garfield Station, near Jericho, is reported to have purchased a machine for use in working his pastoral properties, and to keep in touch with his Bilbah Downs, in the Isisford district. The Central Queensland Graziers' Association is also purchasing an Avro 3-seater for organizing purposes. It is suggested that these will be the forerunners of others, and that a company will be promoted to supply machines.

D'Annunzio Quits Fiume in Aeroplane

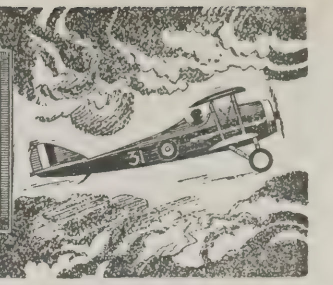
D'Annunzio has issued a proclamation declaring that it is not worth while dying for Italy. He said he was leaving Fiume by aeroplane.

This was semi-officially announced together with the announcement that the Fiume agreement may be regarded as concluded.

This settlement is based on recognition of the Treaty of Rapallo, disbandment of D'Annunzio's legionaries and general amnesty.



ELEMENTARY AERONAUTICS and MODEL NOTES



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The Huntington Motorcycle Engined Monoplane

(*Continued from page* 449)

As an example of the small stresses imposed upon a ship of this size, let us consider the conditions of the rear struts. The center of pressure of the U. S. A. No. 4 section at 2° incidence is 67% of the chord from the leading edge, equivalent to about 36″ for the 54″ chord. The front spar is located 8¾″ from the leading edge and the rear spar 28¾″ behind the front spar. At 2° incidence therefore the rear spar will carry approximately 95% of the total load. Each wing, of course, carries one-half the total weight or 200 pounds. From this we deduct 25 pounds for the weight of the wing, leaving a lift stress upon the wing of 175 pounds. The rear spar carries 175 x .95 = 166.25 lbs., this stress being applied approximately 54″ out on the wing. Since the lift strut is attached to the fuselage at a point 30″ below the wing hinge, the tension in the strut will be approximately 310 pounds, allowing a factor of safety of ten to design fittings suitable for taking the specified load.

Due to the simplicity of the bracing, the wings may be removed from the fuselage by one person in about five minutes and assembled in a similar length of time. As the span occupied by the ship with the wing dismantled is only 5½ x 14 ft., the housing problem holds no difficulties.

Below is a table of summing up the resistances of the various parts of the plane at 52 miles per hour:

1.	Wing Drag	25 lbs.
2.	Fuselage	12 lbs.
3.	Engine Cylinders	3 lbs.
4.	Pilot's Head	2 lbs.
5.	Lift struts and wires	2 lbs.
6.	Chassis	4 lbs.
7.	Empennage	2 lbs.
	Total Resistance	50 lbs.

Then, horsepower required $= \frac{\text{R (resistance) V (velocity)}}{375} = \frac{50 \times 52}{375} = 7$ h. p. required at the propeller.

Wings

The wings are built up in the conventional manner, of spruce throughout, with the exception of the rib webs which are of whitewood. Wing beams are not channeled and can therefore be cut to shape on the saw. The ribs are built up with webs ⅛″ thick, lightened, and spruce capstrips, 3/16″ x ⅜″, glued and nailed to the webs. Ribs are nailed to the spars and held in place by triangular blocks. The entering and trailing edges are of spruce.

The drift bracing stresses are taken by struts ¾″ square forming a Warren truss. This method has ample strength for a small ship and has the advantage of cheapness and ease of construction.

The wings are covered with unbleached muslin one yard wide, sewn to the ribs and given three coats of dope. The ailerons are built up and covered similar to the wings; they are hinged to the rear wing spars by eyebolts.

The four lift struts are identical and interchangeable. They are of solid spruce with a Navy No. 1 section as described in Aerial Age, issue of December 29, 1919. These struts have a safety factor of 12 so that an engine of 20-30 h.p. may be installed in the machine if better performance is desired. They are 1¼″ thick by 3¾″ wide and about 6 ft. in length. Pin joints are provided at each end where the struts join the wing and fuselage. Fittings are of cold rolled steel.

For both the wing and undercarriage bracing, 3/32″ cable is used in conjunction with No. 325 turnbuckles.

Fuselage

The fuselage has a length of 12′ 5″, a maximum depth of 33″ and is 20″ wide at the pilot's cockpit. The longerons and struts are of spruce, the former ¾″ square section. Diagonal bracing is of veneer strips ⅛″ x 1″ of greater width at the ends where they are attached to the longerons and struts by wood-screws. This method of bracing has been used successfully on other machines; it possesses the advantage of light weight and low cost since it does away with a considerable number of small parts such as fittings, turnbuckles, clevis pins, shackles, wires, ferrules, bolts, etc.

Standard stick and foot bar controls are installed, the foot bar actuating the rudder. For aileron and rudder, steel tube or ash may be used for control stick, the former being preferable.

The seat is constructed of veneer, well lightened, placed low in the fuselage, 10″ above the lower longerons. In this position the pilot's shoulders come below the upper longerons and consequently a fuselage of less width is required.

Undercarriage

An undercarriage of conventional form is fitted to two well streamlined spruce Vee struts and fastened by fittings of 16 ga. cold rolled steel. The Vees are spaced by an axle streamlined in a lifting wing section, built up of spruce and veneer, a groove running the length of the wing, providing an axle rest. This small wing not only reduces the resistance of the axle but also exerts a considerable lifting force. The axle consists of a length of steel tube 1″ outside diameter by 18 ga. by 46″.

The wheels are standard 20″ x 2″ covered with cloth to reduce resistance.

Empennage

The stabilizer and elevators are built up as flat plates, covered and doped in a manner similar to the wings and fuselage. Eyebolts are used for hinges as in the case of the ailerons and rudder. The control horns are also similar; they are simply a piece of steel tube ½″ o.d. x 18 ga. x 9″ long, flattened at the ends, after heating, and drilled to take the control cable shackles.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

On the Field

Ted—Wish I was in your shoes.
Ned—Why so?
Ted—Mine leak.

Just So

"Why are these little motor wheels like golf players?
"Give it up."
"Why, because they putt, putt, and then miss."

Different Viewpoint

Kaiser—Can you deny that many London citizens concealed themselves underground during the last Zeppelin raid?
John Bull—No, but they didn't hide through fear.
Kaiser—Well, I suppose you call it bravery.
John Bull—No, English conservatism.—*Chaparral.*

Stronger Than Us

Friend—Is that fellow strong?
Mechanic—Well, I guess! I saw him break a dollar the other day.

"How is Blinks, the stutterer, making out in the automobile business?"

"The poor fellow isn't doing so well. You see, he started to sell Stutz's last year and as yet he hasn't been able to gain sufficiently long interviews."

Precisely

Aviator (to his wife)—We're to have cabbage for supper, I knows it.
His Wife—Why, John Henry, what shocking grammar!
Aviator (sniffing the air)—I reiterate, my dear, I nose it.

While Flying High

"Have you heard the story about the feet?"
"No."
"You have two."

Crawford—I suppose Rockefeller, as usual, was the largest contributor to charity the past year.
Crabshaw—It looks so, the way gasoline is going up.

THE POOR DOG.
"I can follow on a run, a high jump or a swim,
But when my master quits the earth I say good-by to him."

"Hello, what course are you taking?"
"B. A."
"What profession are you aiming at?"
"Oh, I'm heading for the bar."
"Wait a second and I'll go along."

"What are the duties of the American soldiers in Mexico?"

"If the press dispatches can be relied upon, a day's work consists of hunting for Villa one hour, hunting for water five hours, and the rest of the time hunting for lost American aviators."

"Yes," said the aviation enthusiast, "I expect to go to Washington and raise my voice in support of aeronautics for the Army."

"Never mind raising your voice," said the other fellow; "stay here and raise funds."

Good Reason

"Aren't you ever worried when you're 'way up there in the clouds?" was asked the daredevil aviator.

"I always am," he replied. "I never can tell until I get down but what my manager has beat it with the gate receipts."

Did you hear that loud report?
Just as we reached the scene
A wind blew through the office
And blew up our magazine.

Help Needed

O'Hoolahan—"Casey is that sthrong he can raise a barrel ov flour right over his head."
O'Rourke—"Sure, that must be some ov that self-raisin' flour."

Fierce Fluids

"What made the trouble for the original inhabitants of America was firewater."

"Yes," replied Mr. Chuggins, "and what is making the trouble for the modern inhabitants is gasoline."

The story is told of an irate officer in an office job during the war who received a letter that got his goat, but remembering his good breeding, he replied:

"Sir, my yeoman (f) being a lady, cannot write what I think of you. I, being a gentleman, cannot think it, but you being neither, will understand what I mean."

Special Correspondence

The following rather amusing letter has been received from one of the prospective clients of the Salina Airplane Company, Salina, Kansas:

Dear Sir:—

Is that the best airplant that you had here in Marion Co.? I would say not. I would say its a daingerest airoplant to have. How are you interested in Airplant that is noiseless, wind doz not go in your face, raises on 10 or 15 feet run, stip the same, with folded wings and only 8 Horse power motor will carry 2 to 3 persons where as with your 80 H. P. motor. this invention in airial plants will be place to you for $500 cash and $25.00 from every airoplant made and sold. if you are interested come to see me or write me now at Lincolnville Kans or week from this date I have call to McPherson Foundry Kansas. you can see me there. I am ready to sign the contract with money refunded if not aproved with above statement to your own aproval in them. your very truly

(Signed) (Name withheld) "Inventor."

AERIAL AGE
WEEKLY

JAN 19 1921

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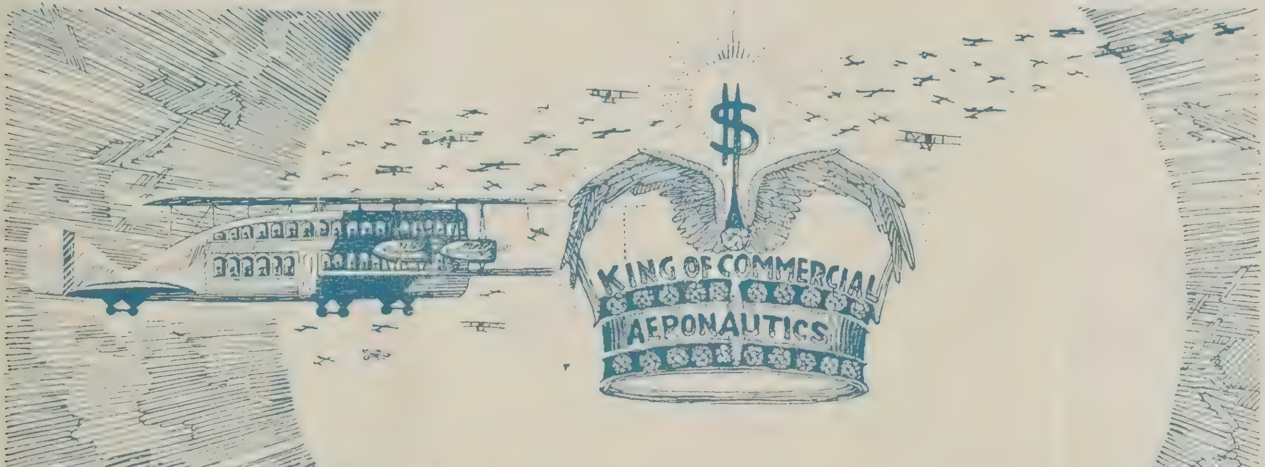

Who Will Wear the Crown?

Aircraft or Battleships?

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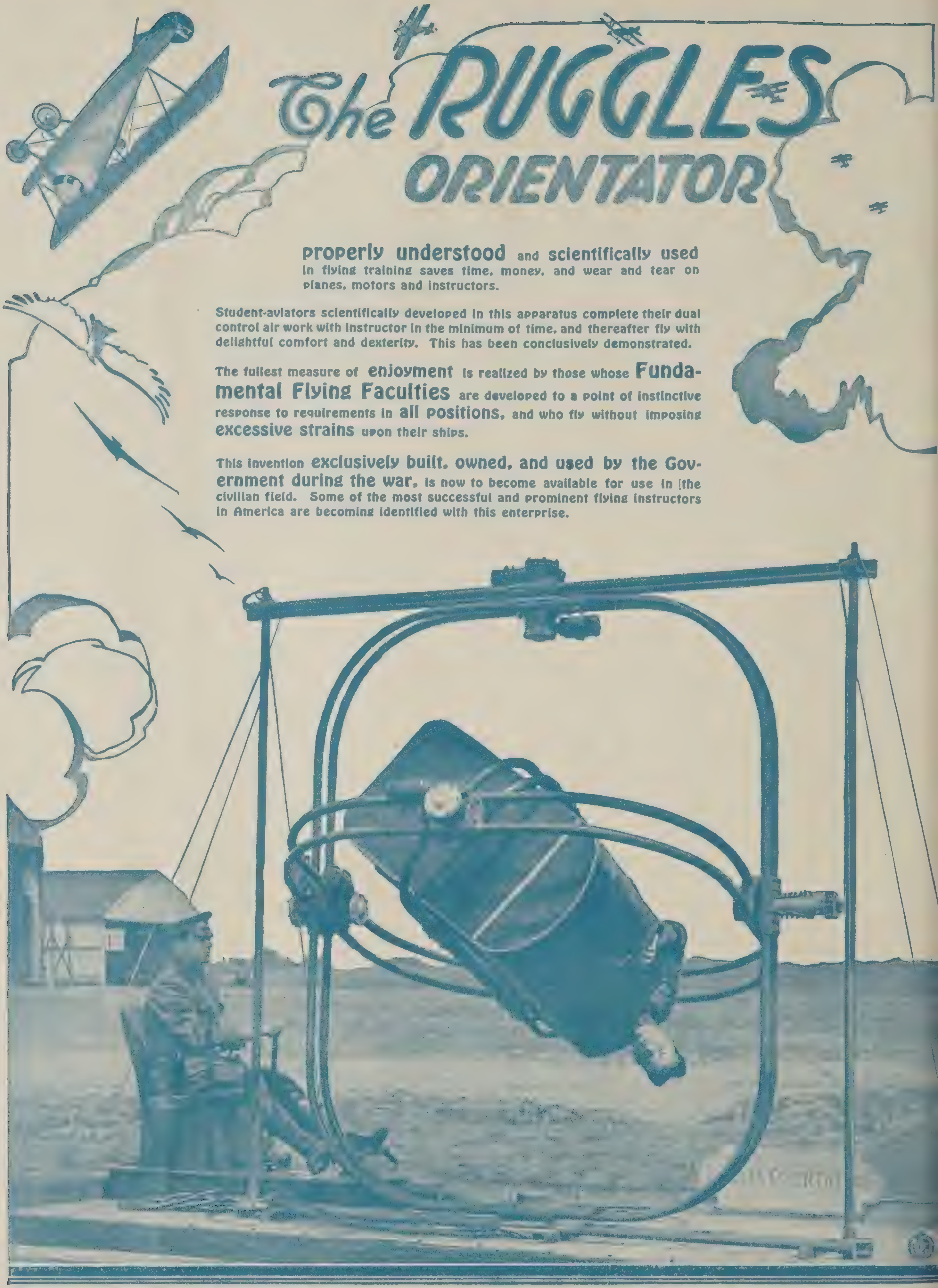

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AIRCRAFT OR BATTLESHIPS?

AT this time, when Congress is considering the Naval appropriations for the next year, it would be well to pause and reflect upon the lessons gained in the war. Eminent authorities of all the important nations are agreed that aircraft have entirely upset the old-time standards of relative naval values, and the wholesale use of submersible craft have had similar reactions.

It is not at all certain now that the capital ship holds pride of place in the assessment of naval power. There is a very powerful school of naval thought which holds that it has in fact passed into obsolescence, and its place been taken by the submarine and aircraft. Those who think thus seem to have a good deal of reason on their side. Before the War, Sir Percy Scott created a sensation in Great Britain by laying down that the submarine was destined to drive the battleship from the seas. Lord Fisher, shortly before he died, went farther than this and said: "We've reached the epoch—prodigious in its advent—when positively the Air commands and dominates both Land and Sea." If Lord Fisher was right—and he is a bold man who would say without enquiry that he was wrong—it is quite clear that all our standards of naval power must be drastically revised. Indeed, it is not revision they require so much as complete revolution.

There are some naval critics who actually look forward to he time—and that within the near future—when the navies of he world will be able to dive, to float and to fly. Lord Fisher did not go as far as this. He seems to have believed that the present battleship would be replaced by giant submersibles, assisted by clouds of aircraft. In the light of present knowledge it appears that he was nearer right than those who are ooking farther ahead. The giant submersible of which Lord Fisher spoke is merely a logical development of the types of submarines which made their appearance towards the end of he War. Some of these wonderful craft were actually armed with a 12-inch gun, so it is quite easy to foresee that the building of even greater submersible craft does not present any insuperable difficulty. If the present-day capital ship were replaced by numbers of such craft, together with numerous aircraft, it requires little imagination to see what might happen o an enemy's surface ships. We have only to recollect that over fifty destroyers were required to escort the damaged *Lion* nto harbor after the Dogger Bank battle to arrive at some ealization of what the submarine menace was even at that omparatively early date. As we have said, it is not for us o here enunciate decided views on so vital a subject one way r the other, but we do think we are entitled to say that, having n view the wonderful developments which have been made in ircraft, and the probabilities of the future, that this question which is now being debated is of so uncertain and controversial nature that Congress will do well to sift and examine every estige of evidence and opinion available before coming to efinite conclusions as to its future building policy. At least e can and do urge that in any case, there must be no mistake made in not providing an adequate Air Force to act not only as the eyes of the Fleet, but for purposes of offensive against those mammoth ships of any possible enemies about which so much difference of opinion appears to exist just now.

A program calling for a 25% expenditure on aircraft, 25% on submersibles, and the remainder on organization and surface ships, would about meet the situation.

Naval Aviation

THERE is no bureau of naval aviation at the Navy Department, no control office, no one directing head having authority and responsibility for the organization and development of an air force for the navy. Until such a bureau is established, it will be obviously impossible for the Director of Aviation to make headway. His hands are tied.

Aviation is distributed among several bureaus pulling in different directions, and nothing of real importance is being accomplished. An organization was submitted to the Secretary of the Navy in 1913, but he did nothing to establish it. To-day he advocates a bureau—seven years later!

The difference between army and naval aviation does not seem realized in Washington. But the material, the machines, the functions and the tactics cannot be the same in many respects in the army and navy. Army machines fly between points of land, start from the land and alight on the land, which is always stationary. Navy machines, on the other hand, must at times start from the sea or from ships that are moving, pitching and rolling, and they must sometimes land on a moving ship or in a rough sea.

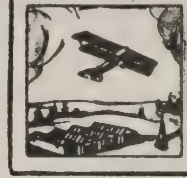
Intelligence and organization at the Navy Department are imperatively demanded.

1. Establish a bureau of aeronautics.
2. Develop aeroplanes, bombing planes and torpedo planes for naval uses.
3. Develop means for starting and receiving aeroplanes on the deck of a ship at sea or in the water alongside.
4. Build aeroplane carriers with a speed of thirty-five knots for service with the fleet.
5. Drill and develop the personnel of the naval air force to navigate and serve with the fleet.

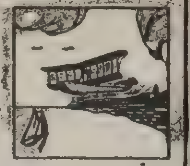
There are individuals who know nothing of ships, seamanship or navigation who claim that a landsman aviator, with no naval training, can wrestle with naval conditions. It is preposterous!

A well-organized and efficient air force is vitally necessary in a modern fighting navy. It is fully as important as a submarine force. Without these two forces a surface fleet of dreadnoughts is powerless, offensively and defensively.

There is not one up-to-date long-range submarine in the United States Navy to-day. The United States naval air force is grossly inadequate. The condition is precarious.—*Editorial in N. Y. Tribune.*



THE NEWS OF THE WEEK



Pulitzer Race for Detroit

Caleb Bragg, chairman of the Contest Committee of the Aero Club of America, announced that the Aviation Country Club of Detroit had been awarded the privilege of holding next year the aerial races for the Pulitzer Trophy, and that the race will be flown next Labor Day.

This race, which was flown over a circular course on Long Island Thanksgiving Day, is the premier aerial event of the year in American aeronautics, and it is expected that at least 100 of the fastest aeroplanes in existence will participate in the Detroit race.

Besides the magnificent Pulitzer Trophy—the gift of Messrs. Ralph, Joseph, Jr., and Herbert Pulitzer—the Aviation Country Club of Detroit announces a purse of $10,000 in gold to be awarded to the contesting flyers.

The first race for the Pulitzer Trophy this year was won by Capt. C. C. Moseley, flying the United States Army's famous 600-horsepower Verville-Packard.

The race Labor Day will begin at the United States Army Air Service plant at Selfridge Field, just outside Detroit, where ample hangar and "gas" facilities and a suitable flying field will be at the service of all the flyers.

The race will be flown over a triangular course of forty-five miles, the first leg at the Aviation Country Club of Detroit and the second to the Packard Flying Field, with Selfridge Field as the third turning point.

Chairman Bragg said the Aviation Country Club of Detroit has just completed a fine club house and flying field and the interest in aviation there is particularly keen. Forty-four machines were entered in the last running of the Pulitzer Trophy race. It is expected that double that number will participate in Detroit.

Plane, Carrying Six, Sets Non-stop Duration Mark

San Diego.—Establishing a new American non-stop duration record for pilot and five passengers for seaplanes, the United States naval seaplane NC-5 flew from this city to Magdalena Bay, Lower California, in the remarkable time of 9 hours and 15 minutes on January 1.

The big triple-motored plane covered the 702 miles between Point Loma and Magdalena Bay at an average speed of 72 miles an hour, the fastest time ever made on this coast by a seaplane of this type.

The naval air station reported that the flight of the NC-5 was the longest in the history of naval aeronautics and exceeded by about 65 miles the longest jump made by a seaplane in the memorable trans-Atlantic flight.

The NC-5 had been delayed two days at San Diego by a wreck. In starting to-day she had planned to fly only to San Bartolme Bay, the first day's stop, where she was to join the NC-6. Instead, the NC-5 continued the flight to Magdalena Bay.

Navy Offers Prize for Plane Model

Washington.—The Navy Department inaugurated a competition for aircraft designers in an effort to obtain an aeroplane capable of starting from the deck of the ship, but also equipped to land in the water. Competitors will be required, to submit general data on plans and where a suggested method is accepted more time to prepare designs for the final competition will be allowed.

No reward for the winner was announced, but it was intimated that a number of aeroplanes would be constructed from the successful plans on which the inventor would earn royalties.

Richmond Aero Club Forming

A meeting has been called in Richmond, Cal., by O. H. Mattley, an aviator, who resides there, to discuss the formation of an aero club in Richmond. The meeting will be held in the Chamber of Commerce rooms, the officers of that body backing the idea.

The Aero Club will purchase a machine and Mattley promises to give lessons free to members. The club will function along practical lines without social activities and has for its object the advancement of commercial and recreational aviation in Richmond.

Fast Air Trip in Mexico

Mexico City.—The aviator, George Puflea, piloting a Lincoln standard aeroplane, manufactured in the United States, made the trip from Mexico City to Tampico in 2 hours and 45 minutes. Puflea took off from the National Aviation Field at 6:30 o'clock on the morning of New Year's Day, arriving at Tampico at 9:15. The trip was made over an unknown country and using an ordinary map purchased on

(© Keystone)

A remarkable airscape of Davos, one of the popular Swiss resorts. The black line is the highway, cleared of snow.

the street half an hour before the flight.

The aviator circled over the city to get his bearings, then made a straight flight over Pachuca to Tampico. Heavy low-hanging clouds forced the aviator to make the trip over Tuxpan, adding fifty miles to the flight. He then followed the coast line to Tampico.

The distance is over 300 miles and his flight was over four distinct ranges of mountains where no roads exist to help the pilot locate directions.

Upon arrival at Tampico the aviator found it impossible to get gasoline for the aeroplane, making impossible a return trip to Mexico City the same day. Owing to poor telegraph service news, the safe arrival of the aeroplane was unknown in Mexico City until Sunday.

New York City Aerial Ordinance

After a conference with officers of the Air Service of the United States Army and representatives of aero associations, F. H. La Guardia, President of the Board of Aldermen, announced that an agreement had been reached on all the essential features of the proposed ordinance to regulate the flying of aeroplanes over this city.

There was some argument, Mr. La Guardia said, over what constituted a safe altitude. It finally was agreed that the ordinance will prohibit aeroplanes from flying over the city at an altitude of less than 2,000 feet. An agreement also was reached as to the definitions of landing places, emergency landing places and gliding angles. The ordinance, Mr. La Guardia said, positively will prohibit the dropping of literature from the air and there will be no "stunting."

At the conference were Major Christie, commandant at Mitchel Field; Lieut.-Col. Hickham, of the Bureau of Aerial Strategy, Washington, D. C.; G. L. Gardner, representing aero publications; Charles A. Boston, chairman of the Aero Legislation Committee of the Bar Association, and Major Reed Landis.

"The objection was brought up," said Mr. La Guardia, "that such an ordinance as is proposed would be unconstitutional. I reminded them that the aviators had overcome gravity and that we likewise would try to overcome whatever trouble there is with the Constitution. However, even in a piece of legislation as necessary and sound as this, I expect opposition from the same quarters which have opposed all aviation legislation in Congress and elsewhere."

Air Service from Paris to United States Planned

That a large corporation backed by French, American and British capitalists is being formed to operate a Zeppelin passenger service from Paris to a point yet to be determined in the United States is the statement reported to have been made by Col. A. B. Carrington, prominent tobacco man just back from Europe.

While abroad he made the acquaintance of one Harry Vissering, of Chicago, who said he was identified with the concern. Details of the enterprise, which is said to have the backing of many thousand pounds sterling, are being mapped out minutely, that they may be executed when commercial flying is more advanced, Mr. Vissering told Col. Carrington, adding that the plans had been in course of formulation for two years. The airships, it is said, will make the trip within thirty-six hours. Meteorologists have been employed for some months in America experimenting to determine the logical American terminal.

Vissering said that a point in Virginia has so far proved the most desirable. Col. Carrington was also told by Vissering that the American terminal would probably be in Virginia and has taken the matter up with the Danville Chamber of Commerce.

Cloudster Nearing Completion

The giant aeroplane "Cloudster," under construction by the Davis-Douglas Company of Los Angeles, will be ready for official tests during January.

The builders expect to set several new American and world's records during the trials.

Pasadena Flying Activity

Pasadena is making a strong bid at becoming one of the most important centers of commercial and pleasure flying during the winter months.

The Sierra Aircraft Company carried around 2,000 passengers last season and early activity this season would indicate that the tourist business will be greater than last winter.

A. H. Hayes, a wealthy Pasadena flying enthusiast, is operating the municipal field at Altadena. Frederick Whitney, well-known local flyer, is in charge of the aerodrome.

G. E. Barnhart's new twin-motored job will be completed within a month, and will probably be operated as a passenger-carrying ship from one of the local fields.

It is reported that several Pasadena merchants are planning to buy planes this winter.

Airscape of the Columbia University Group of Buildings Photo U. S. Army Air Service

The AIRCRAFT TRADE REVIEW

Rogers Airport Opens

The old Chaplin Aviation Field in Los Angeles which was closed several months ago is now open under the able management of Emery H. Rogers.

Rogers Airport is the name under which the field will be operated, and from information given out by Mr. Rogers the field will be offered to the city of Los Angeles free of charge. Hangar space will be available to owners of private machines at reasonable rental. Repair shops and service will be maintained for aeroplane owners. Passengers will be carried in new Pacific Standards, the product of the Pacific Airplane and Supply Co. of Venice. Persons desiring to operate intercity airlines will be invited to use this field as their Los Angeles base. A special service has been arranged to and from the field with the Yellow Taxi Service at reduced rates.

Residents of Southern California and winter visitors will be afforded the opportunity of seeing aeroplanes put to strictly commercial uses. For some time the general public has looked upon the aeroplane skeptically, but they are now realizing that their conceptions of the uses of an aeroplane were erroneous and that the present day commercial plane is the fast transportation medium.

Stunt flying will not be encouraged at this field and the true value of the aeroplane will be shown instead. Trips will be negotiated between Southern California points and the announcements made of the time required for making such trips so that the public in general will be thoroughly informed as to the necessity of utilizing aircraft for fast transportation.

Large Passenger List

The Bluebird Aviation Company of Los Angeles have been "barnstorming" the towns in San Bernardino and Riverside counties and claim to have carried over one thousand passengers during the month.

New Company Active

The Rex Aviation Company, which has been active at Lynwood, California, is looking for a location at Long Beach. Birger Johnson, who heads the new company, expects to operate five ships in commercial work.

Strength of Southern Pine and Douglas Fir Compared

There is little difference between the strength of the Southern pines and that of Douglas fir from the Pacific Northwest, tests made at the United States Forest Products Laboratory show. True longleaf yellow pine averages heavier, stronger and tougher than Douglas fir. True shortleaf pine averages heavier and tougher than the fir, but is about equal to it in strength as a beam or post. Loblolly pine, though averaging heavier than the fir, is somewhat weaker. The difference in strength between any of these pines and Douglas fir, however, is not so great but that low density pieces of the one species are weaker than the average for the other species.

As far as strength properties are concerned, the choice between any two lots of Southern pine and Douglas fir will depend upon the grade and density of the timber composing each lot. The Rocky Mountain type of Douglas fir averages considerably weaker than the Pacific Coast type.

Materials Used in Dry Kiln Construction

Any of the ordinary building materials—wood, brick, tile or concrete—may be used in the construction of a dry kiln. The choice between them will depend upon the relative importance of the first cost, maintenance and fire hazard. The following comments on each type are based on the experience of the U. S. Forest Products Laboratory.

Where insurance rates permit, a well-built wood kiln is very satisfactory, wood being a very good insulator, easily repaired, and cheaper than the other materials. The chief objection to the use of wood, aside from fire risk, is its tendency to swell and shrink with alternate moist and dry conditions, causing more or less working of the frame and loosening of nails. All lumber should be thoroughly seasoned. Fir, Douglas fir, yellow pine, redwood, cypress and similar woods with low shrinkage rates should be used for sheathing and sills. For frame timbers any good straight-grained material is suitable. The sheathing should be shiplap laid horizontally and nailed twice at each stud, in the middle and at the bottom of the board. Outside walls should be sheathed on both sides or sheathed inside and plastered outside. They should also be insulated with a good moisture-proof, heat-resistant insulator. The ordinary quilt insulations sewed between so-called waterproof paper have not proved satisfactory in dry kiln construction. Walls should be painted on the inside with asphaltic paint. Where lumber is plentiful, crib or laminated construction may be used, the walls being built up of 2 by 6 inch planks laid flat, and the roof of similar material laid tight together. If the planks are well seasoned and well manufactured, this form of construction permits very little heat loss; but if the lumber is low grade and knotty a tight, weather-resistant construction is extremely difficult to obtain. The shrinkage of the walls is excessive, and causes considerable trouble at door jambs and where pipes pass through the walls.

Brick or hollow tile is procurable almost everywhere, and where permanency is desired is usually more satisfactory than wood. The brick or tile should be hard burned. The walls should be laid up in tempered or cement mortar. Unequal expansion in the exterior walls, caused by the difference in temperature of the outer and inner faces, is almost certain to create numerous small cracks, which should be painted up with an elastic cement rather than mortar. A kind of tile should be chosen that has openings running horizontally rather than vertically in the wall. The tile should be scored for plastering. Both sides of tile walls should be plastered with cement mortar. When brick, tile or concrete kilns are over 50 feet long it is advisable to build both the exterior and interior walls 12 inches thick, particularly if fireproof roofs are used.

Walls of monolithic concrete or of concrete blocks are highly absorbent of moisture unless thoroughly waterproofed. It is very difficult to hold a high humidity within a kiln whose walls absorb moisture readily. The heat loss through such walls is also very great.

Change of Address

The New York office of the C. L. Maguire Petroleum Company, Whitehall Building, New York City, was moved from the twelfth to the tenth floor of that building on January 1st, in order to provide more commodious quarters.

De Havilland on Civil Aviation

In an interesting letter to *The Times* recently Mr. G. de Havilland makes the following statement:

"The difficulties which beset aircraft transport companies are causing pessimistic views to be put forward which are not justified. Aeroplanes can now do five ton-miles per gallon of petrol of net freight at 100 to 120 m.p.h. when filled up for a 350-mile journey. The initial cost of an aeroplane of this type at the present high prices is about £6,000, and its gross earning capacity at full load is between £150 and £200 per day. Depreciation was at first assumed to be 50 per cent per annum. Experience has shown that 20 per cent per annum is probably too high, and it is now obvious that the rate of depreciation and cost of upkeep can, in the near future, be made less per ton-mile than that for a motor lorry. These figures do not rely on a future type of aeroplane, but on one which has been in hard service for some months. It will be seen that the aeroplane is as economical as a motor lorry, and has at least 100 m.p.h. greater speed.

"The future of civil aviation is so obviously great as to need no pointing out. The present difficulties have nothing to do with the inherent capabilities of aircraft as a means of transport, but are due to many causes, such as the use of unsuitable converted military machines, the cost of pioneer work, the entire absence, to begin with, of load, and the gradual building up of a new industry. Most of this preliminary work is now accomplished, but resources have been used up in the process, and the results obtained show that any transport company which is able to obtain the very moderate capital which would enable it to obtain modern commercial aeroplanes, and ruthlessly scrap unsuitable material, is assured of immediate and increasing success. Government assistance of the kind which has been proposed, *i. e.*, a subsidy based on the amount of the gross takings, would certainly help things over a difficult period. The present difficulties are those which might attach to the commencing of any totally new industry; they are not inherent or technical."

THE WEATHER BUREAU NEPHOSCOPE

THE nephoscope to be described has been recently developed in the Instrument Division of the Weather Bureau, Messrs. C. F. Marvin, B. C. Kadel, S. P. Fergusson, R. N. Covert, and E. L. G. Rauh, all contributing suggestions. While the principle of the instrument (originated by Aime in 1845) is old, the present form is believed to be the best thus far devised for general use at Weather Bureau stations.

1. *Description of nephoscope.* — The nephoscope adopted by the Weather Bureau in 1919 consists of three main parts, as shown in figure 1: (1) The nephoscope proper, which is a black mirror mounted in a circular frame graduated in degrees, and which is supported on three pegs of equal length, so that when the three pegs are set on a level surface the top of the mirror is likewise level; (2) a substantial support for the nephoscope, consisting of a heavy flange or base designed to be attached to a suitable platform or other mounting, an upright section of standard 3-inch pipe to give proper height, and an upper flange of generous dimensions to support the nephoscope and to support also a movable sighting eyepiece stand; (3) a movable sighting eyepiece stand, which consists of a moderately heavy cast-iron base, whose purpose is to carry the sighting eyepieces always at the selected heights, 166⅔ and 83⅓ millimeters, respectively, above the surface of the mirror. The top of the flange or table has been faced in a lathe, so that when it is properly leveled the sighting holes will be at the same vertical distance above the mirror without regard to the particular position on the table in which the stand is placed. It will be apparent from the above that the eyepiece stand can be moved on the table to suit the convenience of the observer; and this movement, combined with the rotation of the arm on which the sights are supported, makes possible a great variety of positions from which the observer may view the cloud's image in the mirror. A triangular marker to be pushed across the mirror with its apex coincident with the cloud's image, a ruler graduated in centimeters and millimeters, a small spirit level, and a clock to count time, complete the equipment. A large copper cover is also included, so that the nephoscope may be protected from the weather without the necessity of continuous removal to the office.

2. *Setting up the nephoscope.*—In setting up the nephoscope it is first necessary to select upon the roof of the building, or in some other location suited for the purpose, the best position available for observing clouds. While it is desirable to have the entire sky within range, yet this ideal condition can rarely be realized and it is therefore necessary for the official in charge to make the best possible selection as to location. A reasonably firm foundation should be had, and the roof or platform selected must be rigid enough so that the weight of the observer will not seriously throw the instrument out of level at the time of observation. In choosing the location care must be taken that the observer may have access to the nephoscope on all sides. Where a good wooden platform is available the 19-inch base plate or flange may be bolted directly thereto, but where no such wooden platform is available then it will probably be best to bolt the base plate to the cement or composition roof by means of expansion anchor bolts; or in case the conditions are such that it is undesirable to open the roof, then a concrete foundation may be provided of rather massive proportions so that it will remain in place of its own weight. A block of concrete (fig. 1) five inches thick, made in the form of an equilateral triangle, three feet on each side, with three sections of three-fourths-inch pipe inserted near the points of the triangles, the pipes being threaded and terminating in floor flanges, offers a satisfactory and convenient means of setting up and leveling the instrument. A block of this size is small enough to be moved by two strong men, and at the same time heavy enough to give reasonable guaranty against accidental change in level or in orientation after it has been placed in position.

Plumbers' lock nuts with suitable washers offer a convenient means of leveling up the block of concrete as may be desired. This leveling is best done after the entire instrument is set up and in place. In making up the concrete block suitable holes for the bolts should be provided, and the lower flange or base plate should rest on top of the concrete, not be sunk down into it. After the concrete has hardened and the lower flange has been properly bolted thereto, the 3-inch pipe should be inserted, and the upper flange should be screwed on as tight as two men can turn it, the men standing on the concrete block at the same time. It will then be impossible for one man alone to unscrew the table top accidentally, a proceeding that would destroy the orientation. A blue print of the concrete block and details may be had upon application to the central office. It is desired that the final leveling of the instrument be accomplished with the mirror in place, in a position approximately that in which it is finally to be used. When the nephoscope is clamped to a wooden platform or to a concrete block that is not itself adjustable, then means have been provided for leveling the instrument by the cap screws to be found on the underside of the table flange. These screws may be withdrawn, and shims, which may be in the form of washers of thin sheet metal or even of paper, should be inserted until a correct level is obtained. The shims may also be used under the base plate in a similar manner. This latter means of leveling will be found somewhat more tedious than is the case where an adjustable concrete block is used, but has the advantage of being less liable to accidental change later on. It is well to test the spirit level for accuracy by reversing it.

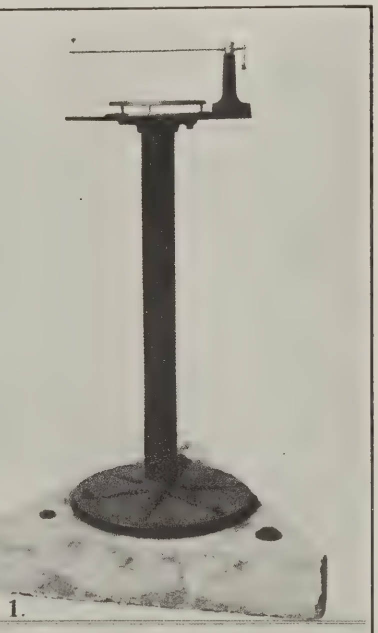


Fig. 1.

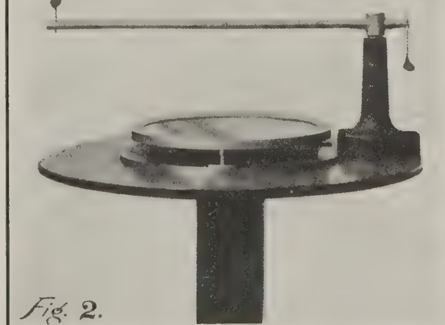


Fig. 2.

3. *Orientation.*[1]—The zero of the graduated scale on the mirror frame should be toward true north, the 90° mark toward east, the 180° mark toward south, and the 270° mark toward west. The actual system to be used, zero to the south, 90° to west, etc., has been reversed in graduating the nephoscope in order that the number appearing on the mirror frame where the cloud's image leaves the mirror may give directly the direction from which the cloud is moving. A simple method of orienting the nephoscope is to suspend a plumb bob at the south side of the iron table so that at true solar noon on a sunshiny day, the 180° graduation, the center of the nephoscope, and the zero graduation may all be brought into a line coincident with the shadow of the suspending thread. It is helpful to have the plumb bob immersed in water, especially if the wind is blowing. The three-arm spider, whose function is to provide an easy and positive means of returning the nephoscope to correct position when desired, should then be tightened by drawing up the clamping nut in the center. It is a good plan to determine at this time and to record in station memorandum book some distant object that is exactly north of the station, so that subsequent inspection for correct orientation may be easily made. For the purpose of determining the time the sun is on the meridian the observer must ascertain the exact difference between the standard time in use at his station and the true local time. To this difference must then be added or subtracted, as the case may require, the so-called equation of time, which is the number of minutes before or after local noon at which the sun passes the meridian. The equation of time is given, approximately, in the accompanying diagram (fig. 12), and more exactly in the following table (Circular D, Instrument Division, Fourth Revision, 1914):

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[1] For a description of the Marvin nephoscope of 1896 and the system of orientation used, see MONTHLY WEATHER REVIEW, Vol. XXIV, January, 1896, p. 9, "Cloud observations and an improved nephoscope, by C. F. Marvin."

EQUATION OF TIME FOR 1899 *a*

Days	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*
1....	+3 53	+13 50	+12 29	+3 53	—3 01	—2 24	+3 36	+6 06	—0 09	—10 23	—16 20	—10 45
2....	4 21	13 57	12 17	3 35	3 08	2 14	3 47	6 02	0 28	10 42	16 21	10 22
3....	4 49	14 04	12 04	3 17	3 15	2 05	3 59	5 58	0 47	11 01	16 20	9 58
4....	5 16	14 10	11 51	3 00	3 21	1 55	4 09	5 53	1 07	11 19	16 20	9 34
5....	5 43	14 14	11 37	2 42	3 26	1 44	4 20	5 47	1 26	11 37	16 18	9 09
6....	6 10	14 19	11 23	2 25	3 31	1 33	4 30	5 41	1 46	11 54	16 15	8 44
7....	6 36	14 22	11 09	2 08	3 45	1 22	4 40	5 34	2 07	12 11	16 12	8 18
8....	7 01	14 24	10 54	1 51	3 39	1 11	4 50	5 26	2 27	12 28	16 08	7 51
9....	7 26	14 26	10 39	1 34	3 42	0 59	4 59	5 18	2 47	12 44	16 03	7 25
10....	7 51	14 27	10 23	1 18	3 45	0 47	5 08	5 10	3 08	13 00	15 57	6 57
11....	8 15	14 27	10 07	1 02	3 47	0 35	5 16	5 00	3 29	13 16	15 50	6 30
12....	8 38	14 27	9 51	0 46	3 48	0 23	5 24	4 50	3 50	13 31	15 43	6 02
13....	9 01	14 25	9 35	0 30	3 49	—0 11	5 31	4 40	4 11	13 45	15 34	5 33
14....	9 23	14 23	9 18	0 15	3 49	+0 02	5 38	4 29	4 32	13 59	15 25	5 05
15....	9 44	14 20	9 01	0 00	3 49	0 15	5 44	4 18	4 53	14 12	15 15	4 36
16....	10 05	14 17	8 44	—0 14	3 48	0 27	5 50	4 06	5 15	14 25	15 04	4 07
17....	10 25	14 12	8 27	0 28	3 46	0 40	5 55	3 53	5 36	14 37	14 53	3 37
18....	10 44	14 07	8 09	0 42	3 44	0 53	6 00	3 40	5 57	14 49	14 40	3 08
19....	11 02	14 01	7 51	0 56	3 42	1 06	6 04	3 26	6 18	15 00	14 27	2 38
20....	11 20	13 55	7 33	1 09	3 39	1 19	6 08	3 12	6 40	15 10	14 13	2 08
21....	11 37	13 48	7 15	1 21	3 35	1 32	6 11	2 58	7 01	15 20	13 58	1 39
22....	11 53	13 40	6 57	1 33	3 31	1 45	6 13	2 43	7 22	15 29	13 42	1 09
23....	12 09	13 32	6 39	1 45	3 27	1 58	6 15	2 27	7 43	15 38	13 26	0 39
24....	12 23	13 23	6 20	1 56	3 22	2 10	6 16	2 11	8 04	15 45	13 08	— 0 09
25....	12 37	13 13	6 02	2 07	3 16	2 23	6 17	1 55	8 24	15 52	12 50	+ 0 21
26....	12 50	13 03	5 43	2 17	3 10	2 36	6 17	1 38	8 45	15 59	12 31	0 51
27....	13 02	12 52	5 25	2 27	3 04	2 48	6 17	1 21	9 05	16 04	12 11	1 21
28....	13 13	12 41	5 06	2 36	2 56	3 00	6 16	1 04	9 25	16 09	11 51	1 50
29....	13 24	....	4 48	2 45	2 49	3 12	6 14	0 46	9 45	16 13	11 30	2 20
30....	13 33	....	4 30	2 53	2 41	3 24	6 12	0 28	10 04	16 16	11 08	2 49
31....	13 42	....	4 11	....	2 33	....	6 09	+0 10	....	16 18	....	3 18

a The equation of time changes slightly from year to year, but the values given in the table may be taken as a fair average of those that ordinarily occur.

When the equation of time is +, the sun is slower than the clock and the specified number of minutes must be added to the true local noon to give the time at which the sun passes the meridian, and, similarly, when the sign is —, the number of minutes must be subtracted from local noon.

For example, suppose the north and south line is to be located at some station on October 3, and where the local time is twenty-four minutes faster than the standard time in use. Hence:

Difference between standard and local time........... —24 minutes
(Use + when standard meridian is east of station and — when west.)
Equation of time, Oct. 3.... —11 minutes

Total correction....... —35 minutes

Therefore the sun will be exactly on the meridian at 12 o'clock, minus 35 minutes = 11.25 a. m., and the shadow of the suspending thread at this moment will be in a true north and south line, which should be permanently fixed by reference to some distant object.

4. *Care of the instrument.*—The iron base plate, the upright pipe and the under side of the top flange require occasional painting; the faced-off portion of the top flange should occasionally be rubbed with a rag saturated with light machine oil; and all brass parts and the glass should be kept clean. The entire instrument is designed to be kept outdoors, but the large copper cover must be replaced after each observation to protect the mirror from deterioration.

An effort has been made to have the bayonet joints by which the copper cover is secured to the top flange spaced exactly 120° apart, but it may be found desirable in practice to mark the position in which the cover fits best, so that it can be returned. Whether or not the little clock may safely be left in place will have to be determined by local conditions.

5. *Observations of direction.*—Having selected in the mirror the image of the cloud whose motion is to be observed, the stand that carries the sighting eyepiece is moved about on the circular table, while at the same time the horizontal arm is shifted until the cloud's image is seen through the hole in the eyepiece at the center of the mirror, indicated by a slight depression drilled in the glass. Keeping the eye at the peephole the image is then kept under observation as it moves toward the graduated rim of the mirror, and the graduation at which the image leaves the mirror is the direction *from which* the cloud is moving. The following table offers a convenient means of converting these angular values into customary 8-point or 16-point values:

8-point system		16-point system	
Cloud moving from—	Image leaves mirror—	Cloud moving from—	Image leaves mirror—
N	158 to 202	N	169 to 191
		NNE	191 to 214
NE	202 to 248	NE	214 to 236
		ENE	236 to 259
E	248 to 292	E	259 to 281
		ESE	281 to 304
SE	292 to 338	SE	304 to 326
		SSE	326 to 349
S	338 to 22	S	349 to 11
		SSW	11 to 34
SW	22 to 68	SW	34 to 56
		WSW	56 to 79
W	68 to 112	W	79 to 101
		WNW	101 to 124
NW	112 to 158	NW	124 to 146
		NNW	146 to 169

6. *Observations of velocity.*—Only the apparent or nephoscopic velocity of the cloud, that is the number of millimeters on the mirror crossed by the image in a given time can be measured, unless the actual height of the cloud is known.

7. *Counting time.*—For the purpose of observing cloud velocities, auxiliary equipment has been provided, consisting of a small triangular sheet of brass, whose apex or point should be kept coincident with the moving cloud by pushing it along the surface of the glass mirror with the finger or with a ruler; a ruler graduated in centimeters and millimeters; and a small clock that beats half-seconds, which is intended to be clamped to the observer's head so that he may by the "eye-and-ear" method keep the cloud under observation during the required number of seconds. A little practice counting beats while watching the second hand will soon familiarize the observer with the method.

8. *Conversion of observed velocities into actual velocities.*—The rules to be presented later are based upon the relations of similar triangles. In figure 3 let AB be a cloud path, assumed to be level; *m* a level flat mirror in which the cloud is observed through the peephole E. Now, since the angle of reflection is equal to the angle of incidence, the triangles ABE′, *cd*E′ and *cd*E are exactly alike in all respects except as to size. Hence their bases AB (travel of cloud) and *cd* (travel of point of reflection) are to each other as their altitudes BD (height of cloud) and EF (height of peephole above mirror.

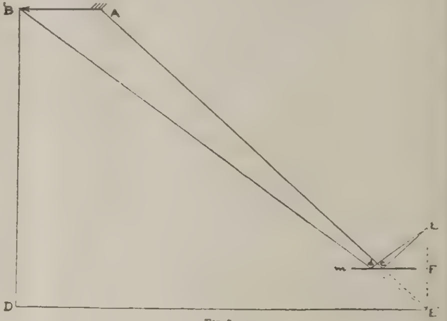

FIG. 3.

O

That is

$$\frac{AB}{cd}=\frac{BD}{EF},\ \text{or}\ AB=\frac{cd\times BD}{EF} \qquad (1)$$

Since it is desired to adopt *meters per second*, as used at aerological stations, for all cloud observations throughout the Weather Bureau, we shall wish to measure the cloud path AB and the cloud's height BD in meters, and the time, *t*, in seconds. The length of the path as seen in the mirror, and the height of the sighting eyepiece above the mirror are measure in millimeters.

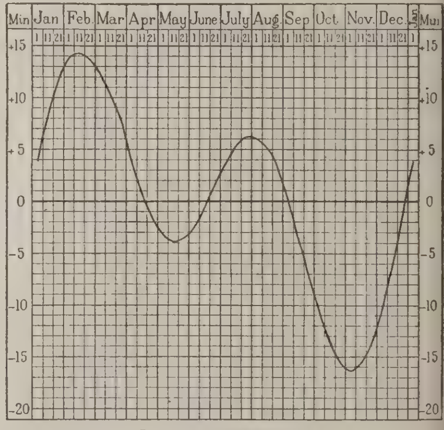

FIG. 12.—Diagram of equation of time.

For convenience in making the computations the nephoscope has been constructed for the measurement of a cloud path at an assumed height of 1,000 meters, from which velocities for other heights may be easily computed.

The velocity of the cloud is defined as the length in meters of the path AB divided by the time it is observed, in seconds,

$$V=\frac{AB}{t} \qquad (2)$$

Substituting for AB in equation (2) its value found in equation (1), we have:

$$V=\frac{cd\times BD}{t\times EF} \qquad (3)$$

Or for a cloud 1,000 meters high and for the nephoscope whose eyepiece is 166⅔ millimeters above the mirror we may write:

$$V = \frac{cd \times 1000}{t \times 166\frac{2}{3}} \qquad (4)$$

Or with eyepiece 83⅓ millimeters above the mirror:

$$V = \frac{cd \times 1000}{t \times 83\frac{1}{3}} \qquad (5)$$

9. *Rules for computations.*—We shall find it convenient in making records and in computing velocities to choose for *t* some suitable fixed value to be regularly followed; and since 60 seconds, or 1 minute, is a value easily remembered, has a large number of factors, and has heretofore been employed satisfactorily,[2] it will be adopted as a standard value of *t*, and all observations will be recorded as of 60 seconds duration. The conversion of the velocity of the image into the velocity of the cloud may then be made by the following rules:

Rule 1. For a cloud 1,000 meters high, and with eyepiece 166⅔ millimeters above the mirror, the number of centimeters crossed by the image in one minute equals the velocity of the cloud in meters per second. (It is generally necessary to express this value in centimeters and tenths.)

Rule 2. For a cloud 1,000 meters high, and with eyepiece 83⅓ millimeters above the mirror, proceed as in rule 1, and double the result.

Rule 3. For a cloud whose height is greater or less than 1,000 meters, multiply the value found for an assumed height of 1,000 meters by the actual height in meters and divide by 1,000.

10. *Examples.*—(1) Suppose the cloud to be 1,000 meters high and the image to move 8 centimeters in one minute, as seen through the higher eyepiece. Its velocity by rule 1 is then 8 meters per second.

(2) Suppose we use the lower eyepiece, 83⅓ millimeters above the mirror, to observe a cloud 1,000 meters high whose image moves 52 millimeters in one minute. The cloud is moving twice 5.2 or 10.4 meters per second.

(3) Suppose that by noting the time required for a pilot balloon to become lost in the cloud layer we learn that the height is 3,500 meters; and from the nephoscope, using the 166⅔ millimeter eyepiece, we learn that the image moves 27 millimeters in 30 seconds. Reducing to the one minute basis we have 54 millimeters or 5.4 centimeters in one minute, which gives 5.4 meters per second for an assumed height of 1,000 meters. Multiplying 5.4 by 3,500 and dividing by 1,000 we have 19 meters per second as the actual velocity of the cloud.[3]

11. *Recording the observations.*—Observations of direction require merely that the graduation at which the image leaves the mirror be recorded, either in degrees or in 8-point or 16-point system, as may be desired for the purpose in hand. Observations of velocity require for subsequent interpretation a record of the height of the eyepiece used, the time the image was observed, and the distance crossed by the image. By standardizing the time to one minute, which may be done mentally, we may further simplify the entries. The height of the cloud, estimated or measured, together with notation to indicate the method used to obtain it, should also be entered.

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[2] Annals of the Astronomical Observatory of Harvard College, Vol. XXX Part LV. "Discussion of cloud observations," p.274.

[3] In actual practice it will be sufficient to consider the heights to the nearest 100 meters for the lower and intermediate levels, and to the nearest 500 meters for the high levels for computing purposes.

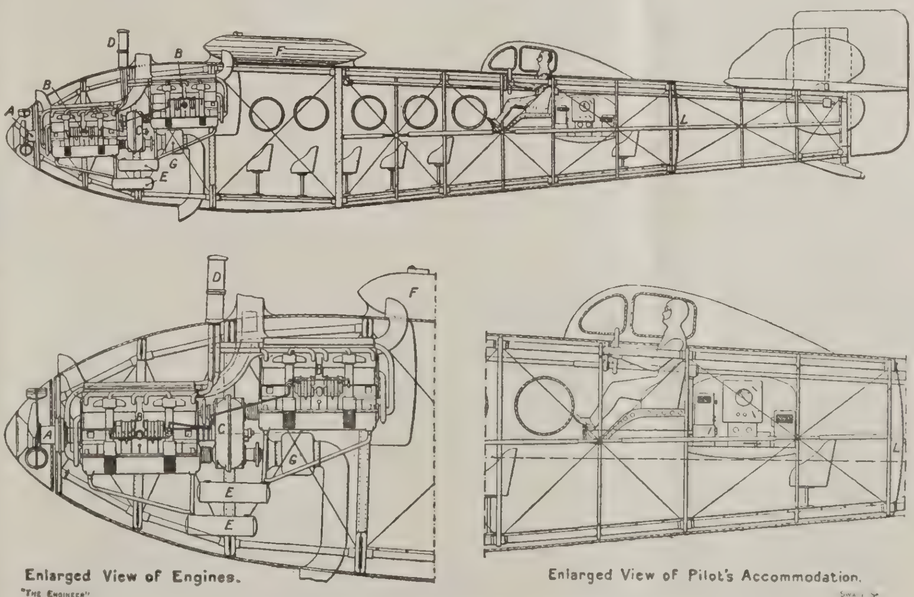
FLIGHT AT HIGH ALTITUDES

THE physiological effects of ascents to high altitudes are now fairly well understood, and in their aeronautical bearing have been made the subject of considerable research by the medical officers attached to the air services of this and other countries. For those requiring a knowledge of this matter we would recommend a paper, "Some Physical and Psychical Effects of Altitude," read last November by Dr. C. A. Swan before the Royal Aeronautical Society. Further interesting information on the same subject is to be found in an article entitled "La Vie et les Voyages aux Très Hautes Altitudes," by Dr. Guglielminetti, which appeared in the issue of our contemporary, *Le Génie Civil* for March 20th. This article possesses additional interest by virtue of the fact that it illustrates and describes a proposed Bréguet passenger aeroplane provided with a completely enclosed fuselage, within which the passengers, the crew, and the engines are accommodated, and within which the air pressure at all altitudes is maintained at the ground level value by means of a pump. With this arrangement not only are the occupants of the machine practically unaffected by the rarefaction of the air at very high altitudes, but the engines are likewise supplied with their full quantity of oxygen at all heights, while as an additional advantage the compression and decompression reaction on the passengers and crew resulting from a rapid descent or accent are avoided. The fuselage, it will be seen, is, so far as the conditions prevailing in its interior are concerned, quite comparable with the body of a submarine, except that whereas the latter may have to withstand an external pressure of three or four atmospheres the fuselage skin has to withstand an internal pressure of not more than half an atmosphere.

The Bréguet high-altitude biplane fuselage is, as shown in the engraving, equipped with four Bréguet-Bugatti motors B on the system exhibited at the Paris Aeronautical Salon last December. The total horsepower developed is 950. All four motors drive the one screw A, and should one or other of them develop a defect it is automatically cut out by a clutch C. The radiator is shown at D, the oil tanks at E, and the fuel tank at F. A turbo-compressor G, presumably of the Rateau type driven by the exhaust gases of the engines, draws in air from the outside and compresses it for the benefit of the crew and passengers and the engines to the value of the pressure at ground level. No information is given as to how the compressor is controlled to accommodate the increase of compression ratio required as the height increases, nor is it stated whether any allowance is made for the fact that as the height is increased the percentage of oxygen in the air falls off perceptibly. The fuselage is made of metal throughout and is air-tight from the nose backward to the bulkhead L.

New Timing Disk

A new timing disk has been developed at Post Field by Second Lieutenant James D. Givens, A.S., Engineering Officer, for the Liberty motor. It is believed that this disk will become generally used in all Air Service stations. The feature which recommends it is that it can be used without removing the prop and radiator. It is equally valuable in the shops as in the field and will be a great saving in time and labor. In addition to this, it is infinitely accurate. Drawings and photographs of each part are being made and forwarded to the Engineering School at McCook Field.



Enlarged View of Engines.

Enlarged View of Pilot's Accommodation.

"The Engineer"

PROPOSED COMPLETELY ENCLOSED FUSELAGE FOR BREGUET AEROPLANE

$60,000,000 REQUESTED OF CONGRESS BY AIR SERVICE

The Chief of Air Service has submitted to Congress its estimated requirements for the fiscal year ending June 30, 1922. The personnel required consists of 1,514 officers and 16,000 enlisted men. The financial requirements are divided into eight groups shown below, the total of which amounts to $60,000,000:

Estimate for Fiscal Year Ending June 30, 1922

	Operation	*Stations and Research*	*Totals*
EXPENSES OF CIVILIAN EMPLOYES			
Pay of civilians in the office of the Chief of Air Service	$ 135,550.00	$	$ 135,550.00
Pay of civilians in the field	6,856,156.00	2,612,000.00	9,468,156.00
Traveling expenses of civilians on rolls in office of the Chief of Air Service	6,500.00	....	6,500.00
Traveling expenses of civilians on field rolls	25,000.00	30,000.00	55,000.00
Pay of consulting engineers	....	4,500.00	4,500.00
Traveling expense of consulting engineers	....	500.00	500.00
Totals	$7,023,206.00	$2,647,000.00	$9,670,206.00
INSTRUCTION AND OPERATION OF AIR SERVICE TROOPS			
Hydrogen, purchase of	$ 300,000.00	$	$ 300,000.00
Aeroplane and their spare parts, maintenance and repair of	1,635,262.00	251,500.00	1,886,762.00
Airships and their spare parts, maintenance and repair of	166,700.00	....	166,700.00
Balloons and their spare parts, maintenance and repair of	19,450.00	....	19,450.00
Engines and their spare parts, M. & R.	1,430,213.00	100,000.00	1,530,213.00
Instruments and accessories for aircraft and engines, M. & R.	75,000.00	....	75,000.00
Machines, general equipment, and tools, M. & R.	100,705.00	80,000.00	180,705.00
Ordnance equipment for aircraft, M. & R.	14,250.00	....	14,250.00
Photographic equipment and supplies, M. & R.	77,000.00	3,000.00	80,000.00
Radio equipment and supplies for Aircraft, M. & R.	....	2,000.00	2,000.00
Hydrogen, maintenance, equipment, operation of plants for production of	82,800.00	....	82,800.00
Text books, books of reference, and publications, purchase of			
Maintenance and repair of equipment, material, and instruments for Air	59,424.00	5,000.00	64,424.00
Service Schools	64,900.00	5,000.00	69,900.00
Purchase of equipment, material and instruments for use at Air Service Schools	407,000.00	25,000.00	432,000.00
Totals	$4,432,704.00	$ 471,500.00	$4,904,204.00
MAINTENANCE AND OPERATION OF STATIONS			
Building and grounds at Air Service stations, M. & R	$	$ 130,000.00	$ 130,000.00
Water	....	4,000.00	4,000.00
Light and power	....	38,000.00	38,000.00
Totals	....	$ 172,000.00	$ 172,000.00
HELIUM, EXPLORATION, CONSERVATION AND PRODUCTION			
Purchase of land for development	$ 25,000.00	....	$ 25,000.00
Lease of land for development of	500,000.00	....	500,000.00
Construction, maintenance, equipment and operation of plants	817,750.00	....	817,750.00
Experimentation with and exploration for	32,500.00	....	32,500.00
Totals	$1,375,250.00	....	$1,375,250.00
EXPERIMENTAL AND RESEARCH, ENGINEERING AND DEVELOPMENT			
Aeroplanes and accessories	$	$1,540,000.00	$1,540,000.00
Balloons, airships and accessories	....	1,259,000.00	1,259,000.00
Engines and accessories	....	538,000.00	538,000.00
Medical	....	18,000.00	18,000.00
Totals	....	$3,365,000.00	$3,365,000.00
PRODUCTION OF NEW AIRCRAFT, ENGINES AND ACCESSORIES			
Special aviation clothing and similar equipment	$ 30,000.00	$	$ 30,000.00
Aeroplanes and their spare parts	17,784,655.00	2,900,000.00	20,684,655.00
Balloons and their spare parts	442,700.00	....	442,700.00
Airships and their spare parts	3,181,000.00	....	3,181,000.00
Engines and their spare parts	....	1,371,500.00	1,371,500.00
Instruments and accessories for aircraft and engines	250,000.00	50,000.00	300,000.00
Ordnance equipment for aircraft	60,000.00	....	60,000.00
Radio equipment and supplies for aircraft	....	30,000.00	30,000.00
Machines, general equipment and tools	560,000.00	40,000.00	600,000.00
Photographic equipment and supplies for use in connection with aerial observation	412,000.00	56,000.00	468,000.00
Totals	$22,720,355.00	$4,447,500.00	$27,167,855.00
IMPROVEMENTS OF STATIONS, HANGARS, SHOPS AND GAS PLANTS; LANDING FIELDS			
Gas plants, hangars and repair shops, construction of	$9,048,000.00	....	$9,048,000.00
MISCELLANEOUS			
Printing plants at Air Service stations, purchase of equipment and sup-	$ 9,000.00	$ 23,000.00	$ 32,000.00
plies for	....	4,000.00	4,000.00
Printing plants at Air Service Stations, M. & R.	60,700.00	15,000.00	75,700.00
Printing and binding, Government Printing Office	90,000.00	10,000.00	100,000.00
Officers expenses while traveling by air	50,000.00	....	50,000.00
Officers mileage properly chargeable to Air Service appropriations	10,000.00	....	10,000.00
Damages, claims for not exceeding $250.00	25,260.00	8,000.00	33,260.00
Salvaging wrecked aircraft, supplies and services in connection with	77,660.00	20,000.00	97,660.00
Office equipment, purchase and repair of	8,000.00	....	8,000.00
Subscriptions to foreign and professional periodicals and newspapers	75,000.00	50,000.00	125,000.00
Miscellaneous services not properly chargeable to other items	115,056.00	36,000.00	151,056.00
Miscellaneous supplies and equipment not properly chargeable to other items	13,750.00	....	13,750.00
Officers tuition	100,000.00	....	100,000.00
Maneuvers, operations			
Totals	$ 634,426.00	$ 166,000.00	$ 800,426.00
FUEL AND LUBRICANTS			
Fuel and Lubricants	$ 3,507,059.00	....	$ 3,507,059.00
GRAND TOTALS	$48,741,000.00	$11,259,000.00	$60,000,000.00

A VARIABLE SPEED FAN DYNAMOMETER

By **KARL D. WOOD, Bureau of Standards**

The following Technical Note descriptive of a Variable Speed Fan Dynamometer, was prepared under the supervision of the Automotive Power Plant Section of the Bureau of Standards, and submitted through the Subcommittee on Power Plants for Aircraft to the National Advisory Committee for Aeronautics for publication.

Fan brakes are widely used as absorption dynamometers in testing internal combustion engines because they are comparatively simple, inexpensive, and flexible. They have, however, the disadvantage that a given fan will run at only one speed when the engine is delivering full power, that speed being determined by the size, proportions, and environment of the fan, and the density of the air. In order to be able to vary the speed at which a given power will be absorbed, English manufacturers have for some time been using a cylindrical housing around the fan with one or two variable openings in the periphery. The tests here reported were undertaken by the Automotive Power Plant Section of the Bureau of Standards to determine how great a range of speed can be obtained with such a device. The tests made show that a power ratio of 5 to 1 can be obtained, power ratio being defined as the ratio of the power absorbed by the fan at a given speed with the outlet open to the power absorbed at the same speed with the outlet closed. Since the power absorbed by the fan varies as the cube of the speed at which it runs, the speed ratio (defined similarly to power ratio) obtainable with such a fan is $\sqrt[3]{5}$ or 1.7. The data show that improvements in the design of the fan brake can make the speed ratio approach but not exceed a value of 2 to 1. The meaning of the terms power ratio and speed ratio is more clearly seen from the diagrams.

Data of the B. F. Sturtevant Company show that the power ratio of a centrifugal blower, which is essentially the same as a fan brake, is independent of the speed and size of the blower, depending only upon its shape and proportions, and it is supposed that this is also true of fan brakes.

A brief outline of previous work on fan brakes, description of the experimental apparatus and methods used in the tests, and a more detailed statement of results are given below.

It has often been shown experimentally that for a given fan brake, the relation of power (hp) to speed (N) is expressed by an equation of the form

$$hp = kN^{3.0}$$

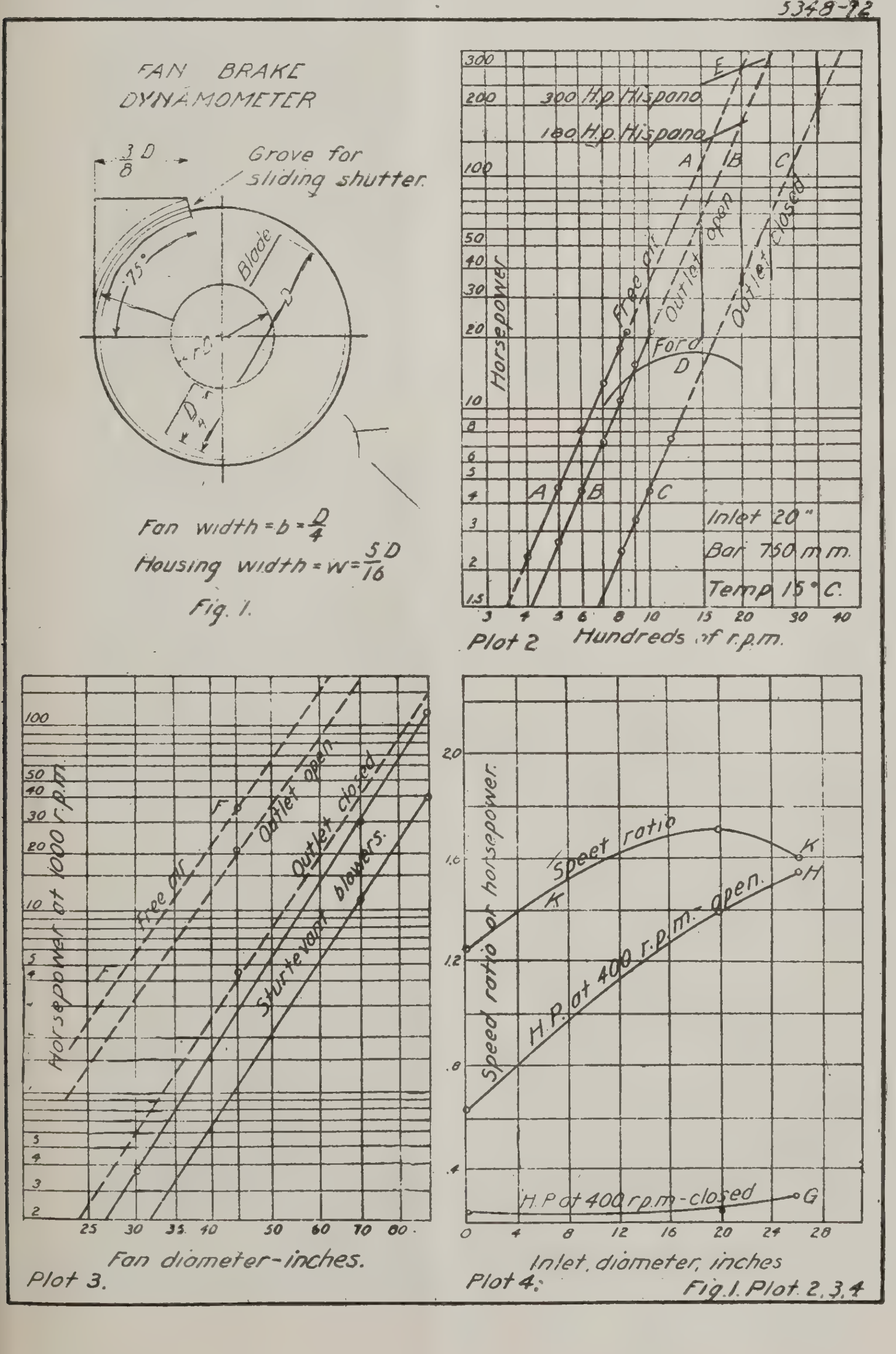
The constant k in this equation depends upon the size, proportion, and environment of the fan and the density of the air. In order to obtain another desired relation of speed to horsepower, one or more of the quantities controlling the constant k must be varied. Control of air density involves such elaborate apparatus as to be discarded at once. Control of size of fan generally necessitates stopping the engine in order to get a different constant, yet this method is used to a considerable extent in commercial engine testing in spite of its inconvenience, as in the Franklin Fan Dynamometer, specifications and calibrations for which are given in the S.A.E. Handbook, Vol. II, p. 45. It is possible to design a device which will change the diameter of the fan blades or the angle at which they strike the air without stopping the engine, but such a device is necessarily rather complex, and may be found unsuited to high-speed work. Fans of this type are, nevertheless, used by several French engine manufacturers. By elimination, it is seen that the control of fan environment is the simplest and easiest method of controlling the horsepower-speed relation of the fan. Morgan and Wood (see bibliography, item 6) give some data on the influence of the environment of a fan on its horsepower-speed relation. They give diagrams showing the effect of a wall in the vicinity of a fan and the effect of putting a square box around the fan. Concerning reproducibility of results, they point out that ordinary weather changes may affect the power absorbed by the fan by as much as 20%, and express the opinion that a fan brake is of little use in exact scientific tests unless some means of measuring the torque is used in conjunction with it.

Although English manufacturers have long been using the method of altering the environment, they are not known to have published any information showing the range of speed control available. Hence, these experiments were undertaken with a view to answering the following two questions:

(1). What range of speed control is obtainable with a fan brake?

(2). Given the rated horsepower and speed of an engine, what is the diameter of fan brake necessary in order to obtain complete tests of power vs. speed?

The general procedure of the experi-



mental work was to mount a two-bladed paddle-wheel fan on a small electric dynamometer, build a cylindrical housing around it, the inlet and outlet of which were of controllable area, and measure simultaneous values of speed and horsepower with different sizes of inlet and outlet. This gave sufficient data to determine the speed and power ratios obtainable by opening and closing the outlet, and the size of inlet for maximum speed control.

The fan consisted of two square pieces of 3mm (⅛″) sheet aluminum about 28 cm (11″) on each side, bolted to a steel arm 10 mm x 76 mm (⅜″ x 3″) by means of steel angles. The diameter of the fan measured from tip to tip of the blades (the nominal diameter) was 1.1 meters (44″). The proportions of the fan brake are shown in Fig. 1, which is a section through the fan blades looking toward the inlet end of the brake. The two ends of the housing were sawed out of slabs of cleated tongue and groove pin and a 45 cm (18″) strip of galvanized iron nailed around the periphery of the ends completed the fan brake except for the sliding shutter. The estimated maximum cost of such a fan brake in January, 1920, labor included, is $25.00.

The fan brake was mounted on a 50-horsepower Sprague electric dynamometer. Data for horsepower-speed curves were taken with inlet diameters of 66 cm, 50 cm and 40 cm (26, 20 and 16 inches) respectively, and with inlet closed, the circumferential outlet opening being changed by steps of 2 inches up to 30 inches (76 cm) open for each setting of the inlet. The outlet uncovered about 75° of the periphery of the housing when the circumferential opening was 76 cm (30 inches). Readings of static air pressure in the housing and air velocity through the outlet were also taken with a view to establishing a reasonable basis for the computation of the horsepower necessary to drive a fan brake of different proportions from the one tested, but no satisfactory formulas were obtained.

Plot 2 shows the experimental horsepower-speed curves for the fan brake tested, plotted on the same sheet with a horsepower-speed curve of the fan in free air and curves of several well-known motors. The observed points are shown in circles and dotted lines indicate extrapolation. The slope of the lines is 3.0; this differs from some other observers' results by as much as 0.1. The horizontal distance between curves B and C, measured with a logarithmic scale, is the speed ratio of the fan brake. For the brake tested the speed ratio was 1.7. The horizontal distance between curves A and C gives the maximum speed ratio that could be obtained by any improvements in the design of the fan brake. It will be noticed that A cuts the 1,000 r.p.m. line at about the same horsepower that C cuts the 2,000 r.p.m. line, so the maximum speed ratio obtainable is 2 to 1. The vertical distance between the two lines gives the power ratio of the fan brake, and is naturally the cube of the speed ratio, or 5 to 1. Since the lines are parallel, the speed ratio is independent of the speed at which the fan is run. This means, of course, that the speed *range* is greater at higher speeds. At 300 hp, a speed range of 1,600 r.p.m. is available, which is more than enough to take a complete full-throttle run on a 300-hp Hispano-Suiza engine. At 18 hp, a speed range of only 650 r.p.m. is available, and this is not quite as great a speed range as is usually used in running tests on Ford motors. Curve D is a typical full-throttle Ford motor curve While the characteristics of a fan brake give it greater speed range at high speed than at low, it must be very carefully built in order to be run with safety over 1,500 r.p.m. Plot 3 shows in heavy lines the curves of horsepower at 1,000 r.p.m. against fan diameter for Sturtevant Steel Plate blowers plotted from data given in their catalogue No. 234. These curves indicate that for fans of different diameter having other dimensions proportional to the diameters, the power absorbed by the fan varies about as the fifth power of the diameter, since the slopes of the curves are 5.3 and 5.1 respectively. The fact that the lines for Sturtevant blowers open and closed are parallel, shows that the speed and power ratios are independent of size of fan, and it is assumed for the purposes of this work that this is also true for fan brakes. The dotted lines are for the type of fan brake shown in Fig. 1. Each is drawn through one observed point with a slope of 5 to 1. They can be used to determine the size of fan required to run a test on a given engine provided an approximate horsepower-speed curve for the engine is known, but a fan built with the nominal diameter indicated on the curve may absorb as much as 10% *more* or 10% *less* power than indicated on the curve.

Plot 4 shows how the diameter of the inlet affects the power absorbed by the fan and the speed ratio. Curve H shows that the power absorbed by the fan with outlet open varies nearly directly as the inlet diameter, and curve G shows that the power absorbed with the outlet closed remains constant until the inlet diameter becomes greater than the inside diameter of the blades, when it increases. The ratio of any two ordinates on the curve gives the power ratio, which is the cube of the speed ratio, and the speed ratio is plotted as curve K to the same numerical scale as the horsepower curves. Curve K shows that if the diameter of inlet is rD (where D is fan diameter), the best value for r is about ½, which makes the inlet diameter just equal to the inside diameter of the fan blades. It might be possible to get a greater speed ratio if the blades were made oblong instead of square, with the axial length greater than the radial depth.

Theoretical and mathematical consideration, which need not be explained here in detail, have been developed to show:

(1) $hp = kN^3D^5$ with proportional dimensions.

(2) In the empirical equation for head resistance in rectilinear air flow, $F = kuSv^2$, where F = force of head resistance, u = density of air, S = area exposed to air flow, and v = air velocity, the constant k for these tests, assuming the resisting torque of the fan to be due only to the air resistance of the flat plate fan blades, agrees within 20% with Eiffel's value as corrected by Duchemin.

(3) In the empirical equation for skin friction in rectilinear air flow, $F = kuSv^2$, where F = force of skin friction and the other symbols are the same as before, the constant k was calculated from the runs with the fan outlet closed on the assumption that the entire resistance to the motion of the fan was due to the skin friction of the cylinder of air on the housing. This constant was of the same order of magnitude as that given by Zahm for rectilinear air flow past a smooth board.

(4) Equations are given in items 4, 5 and 6 of the bibliography for predetermining the performance of fans from their dimensions. While each of these equations was probably true for the particular conditions under which the tests were made, it has already been pointed out that no equation which does not consider air density and fan environment as well as fan dimensions can be generally true within less than 20%.

The conclusions of this investigation are, briefly:

(1) A fan brake can be made to give a power ratio of 5 to 1 or speed ratio of 1.7 to 1, by means of a variable shuttered housing.

(2) Performance of a fan brake of the same proportions as the one tested but of different diameter can be predetermined to about 20% (*i. e.*, + 10% from nominal) by means of the curves given. For accurate work a means of measuring torque must be used in conjunction with the fan brake.

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3. *Marks, Lionel S*.....*Mechanical Engineers' Handbook. Aeronautics and Centrifugal Fans.*
4. *N. A. C. A*..........*Report No.* 55, *on Mufflers. Reprint from Fifth Annual Report. Appendix.*
5. *S. A. E*..............*Handbook, pp.* 45a *and* 45b.
6. *S. A. E*............*Trans.,* 1913. Vol. 8, *Part II, p.* 110. *Prof. W. Morgan and E. B. Wood. The Measurement of Horsepower. (See discussion for formulas.)*

Ricci at Caproni Works

Rolandi Ricci, the new Italian Ambassador to the United States, visited the Caproni Aeroplane Works at Sesto Calende, at the southern end of Lake Maggiore, accompanied by Deputy Grassi and F. Quattrone, Italian financial representative in the United States. They expressed much admiration for a new aeroplane capable of carrying thirty persons on a 500-mile flight, which is almost ready for its first trial.

Signor Ricci was greatly impressed by the amount of work carried on at the factory and expressed the hope that he might meet Signor Caproni again in America, saying that he considered him a collaborator in the work he intends to accomplish in his new post.

From Peru to the States

Juan Laguia, chief of the seaplane service of the Peruvian Government, is planning a flight from Peru to the United States the latter part of this month. Information as to his plans was received in the form of a request from the Peruvian Government to the Salvadorean Government that he be permitted to land on Salvadorean soil in the course of his flight if it became necessary.

University Air Service Approved

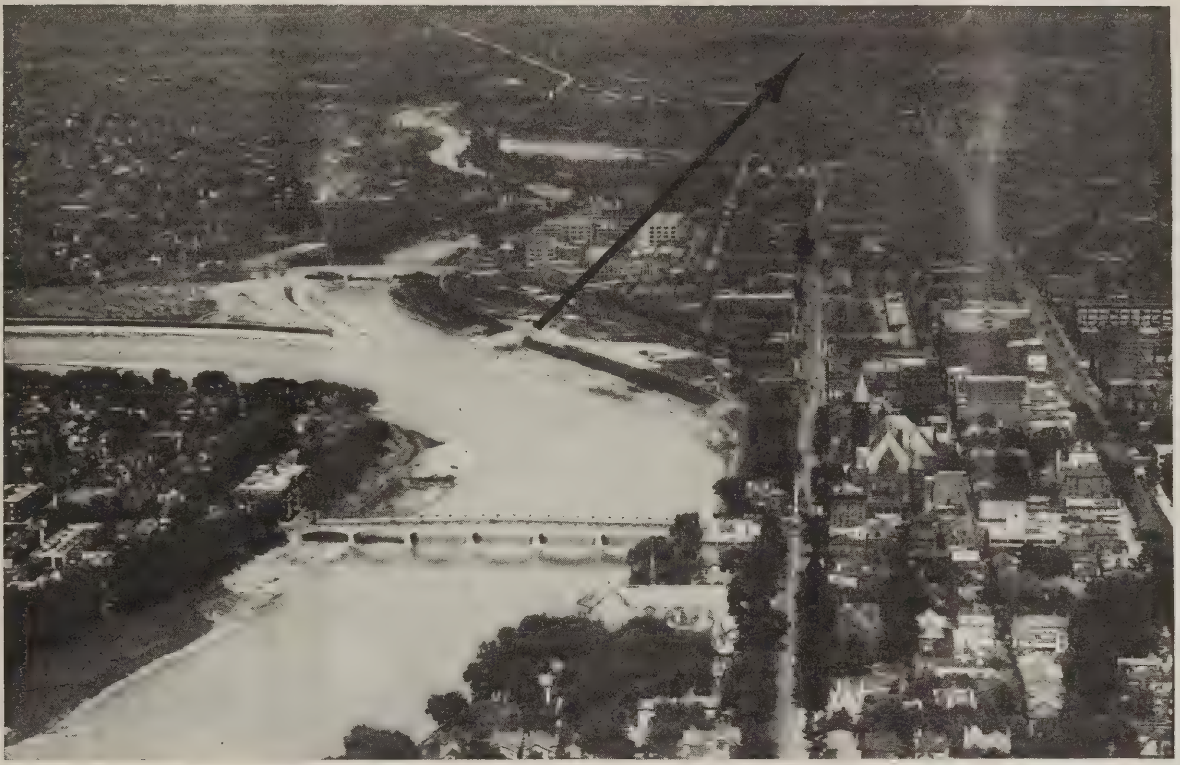
The Secretary of War has given his approval to the project to establish an air service unit at the University of California. The unit will be made up from the Reserve Officers' Training Corps, Senior Division. Faculty members of the department of Mechanical and Electrical Engineering will conduct the courses it is announced by the University regents.

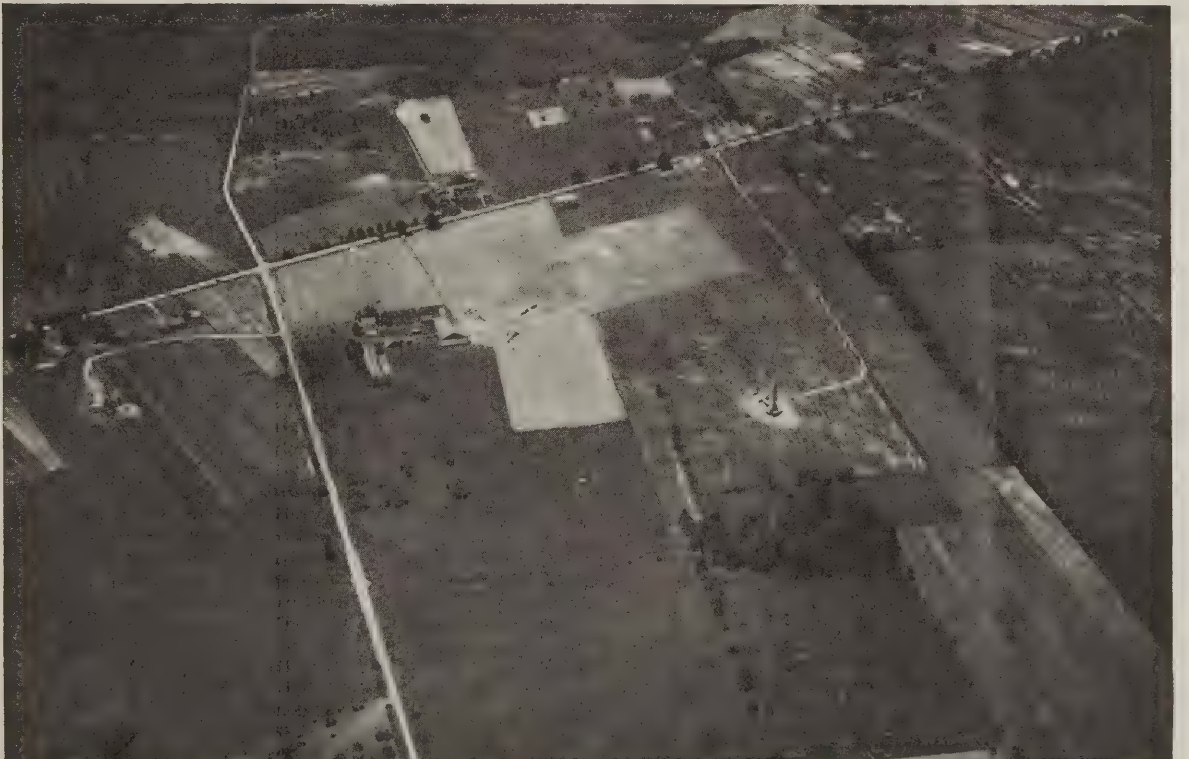
MAPPING THE AERIAL ROUTES

THE newly created civil affairs division of the United States Air Service has undertaken a task which, large as it is, will be accomplished in large part within the next year, and will give to aviation what the automobilist has always taken for granted, viz.: a systematized route plan.

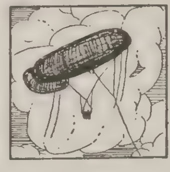
It will be the first of its kind known to aviation, and is intended to serve as a framework and general plan for the entire country. Work on the plan has already begun, and the model route upon which the others over the country eventually will

(*Continued on page* 499)

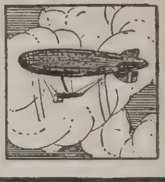




These two photographs when pasted back to back by a special process, form a thin "card" of the aviator's index. The illustration above shows the town as seen by the aviator from the direction of approach, and the arrow indicates the location of the landing field. Illustration below shows view of the landing field as seen by the aviator, and comprises the reverse of the "card." Attached to the card is a brief statement of the conditions to be encountered at each particular field



FOREIGN TECHNICAL DIGEST



Airship Piloting

This paper was presented by Major G. H. Scott before the Royal Aeronautical Society and deals with the subject under four heads:

(a) Aerostatics of Airships.
(b) Aerodynamics of Airships.
(c) Weather with regard to Airships.
(d) Navigation.

The subject is comprehensively discussed and is based on the wide experience of Major Scott in the great war. (*Flight*, Dec. 9, 4 pp.)

Comparison of the Flying Qualities of Single and Twin-Engine Aeroplanes

This paper was read before the Royal Aeronautical Society in London by Squadron Leader R. M. Hill, and deals with control and design; the effect of engine on control; effect on single-engined aeroplanes; effect on multi-engined aeroplanes; details of engine controls on multi-engined aeroplanes.

In conclusion Mr. Hill states:

"Every good pilot, when he really gets to know an aeroplane, whatever its possible defects or complexities of control, evolves his own methods of ensuring during phases of flight which demand cautious handling; not only does he do this, but with surprising flexibility he accustoms himself to the peculiarities of engine and aeroplane control and develops an extraordinary skill in dealing with them so that he can render the aeroplane as docile to his wishes as one which involves comparatively simple problems of control.

"But the pilot is undoubtedly in a much safer position if he has approached the problem using his reason to its fullest extent, rather than by trusting his instinct for everything; and he will always have new types, with peculiarities of their own, which need careful study. What is encouraging for the pilot is the fact that as time goes on applied design will step by step overcome the difficulties which were at one time thought to be insurmountable except by human flying skill." (*Aeronautical Journal*, December, 11 pages.)

The Handley-Page Wing

This article discusses at length the new aerofoil theory developed by Handley Page, which has already been described in AERIAL AGE.

It brings out some interesting points concerning the adaptation of the wing, this form of construction. (*Flugsport*, existing types, and also methods of solving the mechanical difficulties involved in Dec. 8, 4 pp., 1 illus., 12 diagrams.)

Dornier Types

This article describes in comprehensive detail the complete line of Dornier machines from 1914 to date.

Herr Dornier is one of the chief designers of the Zeppelin firm and very early in the war was engaged upon the design of all metal machines of large size, but it was realized by those in charge of the Zeppelin concern that the work was of such a nature that immediate results could not be expected, and so most of the development of this type came in the later stages of the war and since the signing of the Armistice.

This type of machine was probably the first to be built with no form of fuselage bracing beyond that afforded by the plain sheet metal covering. (*Flight*, December 16, 1920. 5 pages, 9 illustrations, 3 diagrams.)

Airship Mooring

This paper was read before the Royal Aeronautical Society of London by Flight Lieut. F. L. C. Butcher and deals very thoroughly with the problems of mooring and handling dirigibles. It contains a very interesting description of the German Handling Trolley as applied to both land and water use.

It also deals with the mooring mast designed at Farnborough and erected at Kingsnorth. The top of the mast revolves and consisted of a hollow cone, the base of which was padded to fit around the nose of the airship. This cone was pivoted at its apex and a balancing weight was fitted on a short arm on the opposite side of the pivot. The nose of the ship was strengthened and a mooring wire spliced into it.

The Barrow Mast Mooring System for non-rigid dirigibles is described, and in his conclusion the writer contends that airships can be moored out in safety and that no technical difficulties exist in re-fueling, gassing and balasting at the mast. (*Flight*, December 16, 1920. 4 pages, 8 diagrams.)

The De Haviland 18

This eight-passenger enclosed aerial limousine is the product of the newly organized De Haviland Aircraft Company, Ltd., which comprises exclusively the principal members of the late aeronautical staff of the Aircraft Manufacturing Company.

The DH-18 was specifically designed for use as either a passenger or freight carrier. Below is given a specification showing the principal dimensions and weights of the machine, together with particulars of its actual performance. The latter figures represent an average of the results obtained during many months running on one of the busiest air lines.

Among numerous refinements necessary in a commercial aeroplane the machine embodies two important features. One is the landing chassis. Its power of absorbing the shock on touching the ground is enhanced by a combination of Oleo and rubber gear. This not only effectively absorbs the shock on landing, but eliminates all subsequent bouncing.

Another feature of interest is that the DH-18 has been specially designed so that it presents a large incidence when the tail is on the ground. This causes the machine to pull up remarkably quickly on landing, a feature particularly important in a commercial aeroplane.

DH-18 machines have been used with conspicuous success and reliability by Messrs. Aircraft Transport & Travel, Ltd., between London, Paris, Amsterdam and Brussels; and, as the result of the efficient service given by these machines, the DH-18 has earned the reputation of being possibly the best commercial aeroplane yet produced.

Specifications and Performance

Engine—
450 h.p. Napier "Lion."

Main Dimensions—

Span	50 ft. 6 in.
Chord	6 ft. 6 in.
Overall length	38 ft. 10 in.
Overall height	13 ft. 0 in.

Capacity—
8 passengers or 2,200 lbs. of freight in 255.75 cubic feet.
(*Note*—Cubic capacity for heavy loads only—200 cubic feet.)
1 Pilot.
105 Gallons petrol.
10 Gallons oil.

Weights—

	With 8 passengers lbs.	With freight lbs.
Machine empty with water	4,040	3,880
Crew	180	180
Useful load	1,440	2,200
Petrol	761	761
Oil	95	95
Total wgt. fully loaded	6,516	7,116

Loading—
W/HP (with 6,516 lb.) = 13.1 lb.;
W/HP (with 7,116 lb.) = 14.2 lb.;
lb./sq. ft. (with 6,516 lb.) = 10.5; lb./sq. ft. (with 7,116 lb.) = 11.5.

Total area of main planes—
618 square feet.

Performance—

	With 8 passengers	With 2,220 lbs. freight
Speed at 1,000 ft.	128 m.p.h.	124 m.p.h.
Speed at 5,000 ft.	125 m.p.h.	121 m.p.h.
Climb to 10,000 ft.	20 min.	25 min.
Ceiling	16,000 ft.	15,000 ft.

Endurance (full speed at 5,000 ft.) 3.3 hours (413 miles) 3.3 hours (400 miles).

(*Aeronautics*, December 16, 1920, 1 page, 2 illustrations.)

Engine Installation

This paper was presented berore the Royal Aeronautical Society of London by A. J. Rowledge, and discusses the gasoline system, oil system, failure of the ignition, overheating, fire, engine starting and engine controls. (*Aeronautics*, December 23, 1920. 2 pages.)

Aviation in the British Dominions

This paper was read before the Institution of Aeronautical Engineers in London by H. Sleeman.

In most of the Dominions conditions for flying are more favorable than in England, and it appears that the development of British commercial aviation will be to a great extent carried out in the Dominions. For purposes of example and illustration, the Australian conditions will be cited, but allowing for the modifications necessary for different climatic and topographical problems, the conditions will apply to most of the other Dominions.

In Australia, the best route, from a flying point of view, is the one between Melbourne and Adelaide, but without flying at night there would not be any gain of time over the existing train service, and, in addition, the loading is not so great as on another route, and would fluctuate violently. The Melbourne and Hobart route, on the other hand, offers exceptionally good loading, and the gain of time amounts to 21 hours on a trip of 430 miles airline. (*Aeronautics*, December 23, 1920, 2 pages.)

NAVAL *and* MILITARY AERONAUTICS

Seaplanes' Panama Flight

San Diego.—The dozen planes of the F-5-L Division of the Navy's San Diego-Panama aerial expedition berthed in San Bartoleme Bay, four hundred miles from their starting point, on December 30th.

Radio reports flashed back to the naval air station had brought word that each of the twin-motored planes had escaped mishap in the first lap of the 3,000-mile flight, but the bigger and heavier NC-5 met trouble which put it out of the flight for a time.

NC-5 was forced to put back into San Diego harbor after having winged its way only a few miles down the coast. Its hull had been damaged in taking off. Officers and crew, with mechanics from the station staff, went to work with a vim as soon as the big seaplane had "taxied" in and was hauled out of the water.

For a time no word was received concerning the NC-6 and some anxiety had begun to be felt, especially after word had come that all the F-5-L type planes had reached their first overnight destination, but early in the evening a radio message reported the plane had "landed" at 4:05 o'clock.

The ships, with a personnel of seventy officers and men, were the largest number of aircraft ever gathered on the Pacific coast for such a long flight. The first ship carried the pennant of the fleet commander, Capt. Henry C. Mustin. It was one of the dozen F-5-L planes in the expedition, and was under the comamnd of Lieut. L. D. Spaulding. The planes of this type were put ahead, the triple-motored NC type being faster and therefore held back.

Captain Mustin is a veteran air navigator, and has spent months of intensive study on problems incident to the Panama flight. He declared the greatest difficulty would be finding suitable anchorage grounds for the seaplanes in unfamiliar west Mexican bays and harbors. The question of fueling also was an important one, he said. Optimism for a successful trip was expressed by the officers and men.

San Diego, Cal., Jan. 4.—Traveling faster than seventy-two miles an hour, seaplanes Nos. 5 and 6 of the N-C Division in the San Diego-to-Panama flight at 4:52 P. M. yesterday reached Banderas Bay, on the Mexican mainland, ending a successful dash from Magdalena Bay.

When the huge machines volplaned to the water the twelve F-5-L machines and the two N-C planes were together for the first time since the take-off from this harbor last Thursday.

Kelly Field Air School Is Moved

Orders for the removal of the Air Service mechanics' school from Kelly Field, near San Antonio, to Chanute Field, Rantoul, Ill., have been received. The first units of the school will remove by January 15, and the complete equipment and personnel will be at the new location by February 1.

The aviation repair depot at Dallas will be transferred to occupy the site made vacant by the school.

The mechanics' school, which was established during the war, is the only one of its kind in the United States. Several thousand persons were graduated from the school during the three years of its operation. Its personnel includes 23 officers and 700 enlisted men and 132 civilian employees.

Preliminary Training Course at A. S. Mechanics' School

The addition of a course of mathematical instruction to every course taught in this school marks another advance in air service instruction. This course, known as the Preliminary Training Course, is of four weeks' duration. It is a short course in elementary mathematics up to and including the principles of algebra and geometry, sandwiched in with some intensive military training. Every student entering this school for a course of instruction must first complete this elementary work before he specializes on a branch of aviation. The military training is directly supervised by a commissioned officer and is given by a number of picked non-commissioned officers, none of whom has had less than ten years' military service. This military work includes Infantry Drill Regulations, including "School of the Company," Interior Guard Regulations, lecture work on Army Regulations, Manual of Courts Martial, Personal Hygiene, Discipline, and other subjects which a recruit needs to know. This course is compulsory, and men attending it are excused from all other duties. It is believed that the addition of this course will mean a material gain in the school's efficiency.

323 Flights at March Field

Three hundred and twenty-three flights were made from the pilots' school at March Field during the past week. Total flying time, 225 hours and 10 minutes. Preliminary instruction required, 137 hours and 20 minutes; advance instruction, 28 hours and 15 minutes; test flights, 4 hours and 50 minutes; and miscellaneous flights, 54 hours and 45 minutes.

Personal Pars

First Lieutenant H. J. Odenthal, A.S., formerly Chief of the Publicity Section in the office of the Chief of Air Service, having been honorably discharged from the Army November 30th, is at present engaged in business in Washington, D. C.

Lieutenant S. C. Eaton, A.S., Office Chief of Air Service, has been ordered to Carlstrom Field, Arcadia, Florida. He will leave for his new post January 1st, 1920.

New Seaplane Derrick

After two years of experiment and delay at the Mare Island Navy Yard, construction has been resumed on a seaplane derrick to be used in salvaging seaplanes wrecked at sea. The derrick will be attached to the floating equipment of the North Island Naval Air Station and the Pacific Air Force.

Authority to construct the derrick was received in 1918. The cost at that time was estimated at $60,000.

The Extent of Radio-Equipped Aircraft

The following will show in a measure the extent of the Air Service Operations which employed radio-equipped aircraft from July 1 to September 30, 1920. This list, however, is incomplete, additional reports having arrived after compilation.

Permanent and temporary landing fields and gasoline stations from which radio-equipped aircraft were operated: (Ground Radio Stations were maintained and operated at practically all of these stations)...	40
Average number of radio-equipped aircraft in commission for these operations	101
Average number of missions *per week* in which radio telegraph or telephone was employed..............	150
Average number of hours flown *per week* by radio-equipped aircraft in these operations	403
Distances over which radio communication was carried on varied, from less than 1 mile to................	200

In addition to its employment in Air Service activities proper, such as Coast, Border and Forest Patrols, and routine work at Flying Fields, aircraft radio was employed in work with ground troops in various parts of the country. In some cases where the ground troops were not provided with apparatus or operating personnel, the Air Service furnished the ground service. Work with Coast Artillery proper covered operations at Fort Hancock, N. Y.; Fort Monroe, Va.; Fort Caswell, N. C.; Fort Scriven, Ga.; Fort Dade, Fla.; Fort Crockett, Tex.; Forts Rosecrans and Berry, Calif., and in the Panama, Hawaiian and Philippine Departments. Work was carried on with Railway Artillery at Camp Eustis, Va., and Rockport, Mass., and with Anti-aircraft Artillery at Fort Monroe, Va. Work was also carried on with the Field Artillery, Cavalry, Infantry and Tank Corps included operations at Camps Bragg and Knox, Leon Springs, and Fort Bliss, Texas; Fort Sill, Okla.; Camp Meade, Md., and Camp Bennings, Ga.

Magnavox Enables Pilot to Converse While in Flight

Sacramento.—Declared to be the first time the feat has been accomplished, a cadet in an aeroplane 5,000 feet above Mather Field talked with those on the ground.

The talking was done with the use of a magavox, under the direction of Lieutenant H. E. Metcalf.

The magnavox was placed on the wing of the aeroplane and the cadet's voice could be heard for miles around.

Los Angeles Ordinance

An ordinance regulating the operation of aircraft in Los Angeles has been adopted by the city council.

The regulations provide that aircraft shall be operated at a height of at least 1,000 feet, that there shall be no stunt flying over populated sections of the city, and that no autos shall be parked on landing fields within the city.

FOREIGN NEWS

Aerial Agreement with France

The text of an agreement between France and Great Britain regarding aerial navigation has been published in the *Official Gazette*. This agreement will cease to be in force as soon as the International Convention for aerial navigation drawn up by the Peace Conference becomes effective. The agreement provides that the two Governments will permit the free passage of private and commercial aircraft while reserving the right to establish prohibited areas for military reasons. All aircraft must carry a log and a traffic permit. The pilots must have a certificate showing their qualifications. The use of wireless apparatus without special permission is forbidden. The respective authorities reserve to themselves the right of examining aircraft on arrival and departure.

British Aircraft Imports and Exports

The value of aircraft imported into the United Kingdom during the month of November was £9, as compared with £44,713 in November, 1919. Exports in this class amounted to £165,607, against £67,831 in November, 1919.

£20 Fine for Smuggling Dog by Air

For bringing an Alsatian wolfhound from France to England by air without a license, Mr. C. Ogle, of Kirkley Hall, Ponteland, Newcastle-on-Tyne, who pleaded guilty, was fined £20 with two guineas costs at Croydon.

No Acrobatics in Switzerland

The Swiss Air Ministry, which some time ago issued a ban on stunting, has announced that, following a new decision of the Government, permits will not be granted in future for any meeting the program of which includes acrobatic flights.

A New R.E.P. Motor

Word comes from Paris that, in view of the possibilities of a Round-the-world flight being held next year, M. Robert Esnault-Pelterie is busily engaged upon the production of a new motor, designed upon novel lines for long flights.

French Commercial Aviation

The following figures issued by the French Air Ministry show the great progress France has made in commercial aviation. The aerial routes now exploited extend to 2,812 miles. Last year the aeroplanes traveled 218,750 miles, but for the first ten months of this year they covered 937,500 miles. There was only one accident for each 75,000 miles flown. While last year the number of passengers carried was 960, up to the end of October this year 6,750 had been carried. A big increase in mails is recorded—from 460 kilogrammes of letters in 1919 to 5,210 kilogrammes in 1920, while cargo has increased from 13,980 to 103,330 kilogrammes.

Morocco Aerial Patrol Greatly Deters Banditry

Although the life of a tourist is considered unsafe if he proceeds farther into Morocco than to the points at which the French blockhouse system assures protection, travellers returned recently from there tell of aeroplane surveillance which has been instituted by Gen. Lyautey, and which is having a tremendous civilizing effect. It would require a standing army of 500,000 to supervise properly every dangerous quarter in a country where religious as well as national ambitions are constantly conflicting, yet ten air squadrons are so efficiently covering the whole territory that in the last few years the number of attacks in the interior are understood to have decreased 90 per cent.

The work is not without its dangerous feature, however, for since the war hundreds of natives who had served in the French army managed to secrete rifles and ammunition in the hills, with the result that the aeroplanes frequently return with their wings riddled with bullets. But these encounters rarely reach the attention of the public, and the French forces, despite casualties, are continuing their efforts to pacify the country, which has never been subjugated by aliens.

The latest effort in social and moral reconstruction is the erection of purely French villages beside native colonies. At first this provoked conflicts, but as the natives saw the wisdom of the French in the systematic handling of their affairs as well as the advantage of living in more sanitary quarters they gradually adopted the French methods.

This wider vision has brought native approval of the French railway projects for connecting Fez and Oran so as to handle properly the transportation of goods from the fertile corridor of Taza. The work on this railroad has proceeded so rapidly since the armistice that only forty miles now remain to be completed, and it is hoped to inaugurate an efficient service before next summer.

Millerand Has Own Plane

Paris—President Millerand, despite the earnest contrary advice of Madame Millerand, is reported to have ordered an aeroplane limousine for the purpose of making official visits to foreign capitals and cities in the provinces.

Should the report prove to be founded it will mean a departure in the mode of traveling of presidents in France and the permanent side-tracking of the presidential train. A regular squadron will have to be provided for the presidential suite and the 50 or so journalists who accompany the president on all his trips from Paris.

Some newspapers call the president's attention to th fact that a fall from the window of his aerial limousine would have more terrible results than leaning too far out of the train window, referring to the accident to the former President Paul Deschanel.

Berlin-Essen Services Prohibited

A semi-official announcement issued in Berlin makes it clear that the recent prohibition by the Inter-Allied Aeronautical Commission of German air services between Berlin and Essen and other places within the fifty-kilometres zone is not due to a new decision on the part of the Ambassadors' Conference, but to a decision taken long ago by tne conference not to allow German military aircraft in the neutral zone.

The Aeronautical Commission considers that this decision is also applicable to German aircraft which were sold after the war to German firms and released for purposes of civilian flying. Negotiations are now proceeding on the subject.

German Activity in Colombia

Under the auspices of the German house, Giessecken & Co., a company has been formed in Colombia with a view to maintaining an air service between Barranquilla and Girardot, 450 miles along the Magdalena river by means of Junkers waterplanes. Each machine is to be arranged to carry a ton of merchandise and three passengers.

Additional £1,935,300 Required for British Air Service

According to a supplementary estimate issued recently it appears that a further sum of £1,935,300 is required for the Air Service for the year ending March 31, 1921. Authority is also sought from Parliament for the utilization of surpluses on certain Air Votes, including excess appropriations in aid amounting to £2,050,800. The items in the estimate are the cost of the formation of five additional squadrons, with their ancillary establishments, the cost of certain new works services, the grant of outfit allowances to certain classes of officers, the meeting of deficits on other Air Votes, and also for the increase in the total estimated ocst of improvements to regimental and other temporary accommodation. The following is a summary of the figures:—

Estimated cost of the formation of five additional squadrons, etc.	£ 267,000	
Estimated cost of new works services	141,550	
Estimated cost of outfit allowances	37,300	
Total deficits	3,540,250	
		£3,986,100
Total surpluses	£1,613,400	
Excess appropriations in aid	437,400	
		2,050,800
Supplementary estimate required		£1,935,300

A statement showing the amounts already voted, and the revised totals for the year 1920-21, is given. Nine votes are included, and the aggregate figures are:—

	Gross Total.	Appropriations in aid.	Net Total.
Original estimate	£22,829,619	£1,772,689	£21,056,930
Supplementary estimate now presented	2,372,700	437,400	1,935,300
Revised estimate	£25,202,319	£2,210,089	£22,992,230

Another Speed Record

Flying one of the Gordon-Bennett Nieuports (300 H.P. Hispano-Suiza) modified to the extent that the pilot is now entirely enclosed when flying, Sadi Lacointe on December 12 succeeded in beating the speed record of 309.012 kiloms. per hour set up a month ago by de Roumanet on a Spad. Flying at Villacoublay and keeping within about three metres of the ground, he covered the kilometre in one direction at a speed of 321.428 kiloms. per hour, while his average for the kilometre, flown in two directions, worked out to 313.032 kiloms (just over 194 miles) per hour.

Holland Regulations Governing Flying Height

The Dutch Government have issued instructions forbidding aircraft to fly over any town or closely-inhabited area in Holland except at such a height that it will always be possible to glide to a point outside such town or area with engines stopped. In no case shall this height be less than 1,000 metres (approximately 3,300 ft.).

What Germany Says

In answer to the Note of the Allied Governments despatched on November 16, prohibiting the manufacture and importation of aeronautical material until three months after Article 202 of the Peace Treaty had been carried out, the German Government has addressed the following Note to the Ambassadors' Conference:—

"The German Government is not in a position to impose on German nationals the fresh limitation demanded. The extension of the period prohibiting aircraft construction would be too great a burden for the financial strength of the aeronautical industry to bear, and it would mean that it would have to make up its mind to abandon its undertakings altogether. In this way a great branch of industry of great importance from the point of view of civilization would be destroyed and the economic strength of Germany weakened still further. The only interest which the Ambassadors' Conference can have in extending the period prohibiting construction is the fear that the resumption of building would, owing to the difficulty of distinguishing between old and new material, make the carrying out of the arrangements for the surrender of war material still harder. As a matter of fact the materials to be delivered have, apart from a small remnant, all been handed over to the Commission of Control, and the German Government is preparing at present for her legal measures to secure the speedy and complete identification of the remaining material.

"The reasons which appear to the Allied Governments to render it desirable that the prohibition period should be extended will thus very shortly disappear. The German Government is quite willing to enter into negotiations as to the manner in whiich control shall be exercised in the meantime to ensure that in the manufacture of aircraft no material shall be used which ought to be surrendered, as well as with regard to the measures to be taken if this should nevertheless be done, and would willingly show itself obliging to the Allied Governments in the settlement of this question. The German Government begs that the question may be considered again, consideration being given to the above explanations, and proposes that in the event of its point of view not being shared by the Allies, the matter be submitted to an impartial arbitration tribunal."

ELEMENTARY AERONAUTICS *and* MODEL NOTES

The Effect of Aspect Ratio On Lift

Aspect ratio of a wing, the relation or ratio between the span and the chord, has an important bearing on its lifting properties. Extensive experiments have been made to determine the most efficient aspect ratio and it appears that a ratio of from 5 to 7 is the proportion giving the most satisfactory lift. Incidentally, this proportion of wing spread is found in a great number of soaring birds.

On a wing (or aerofoil) the air is distributed on its upper surface and lower surface in negative and positive pressures, in varying magnitude according to the wing section. At the ends of the wing, however, the air leaks out in such a way that both the pressure above and below the wing are decreased as it nears the tips. Further, the pressure is distributed along the chord with the greatest negative (or lifting) pressure occurring toward the front of the wing nearer the leading edge, and also the negative pressure on the upper surface is always greater than the positive pressure on the under surface.

Inasmuch as the forward part of the wing gives the most lift, it will be seen that a wing with high aspect ratio has a larger proportion of effective lifting surface than the wing with low aspect; that is to say, under similar conditions, a wing with 5-foot chord and 30-foot span (aspect ratio of 6) contains more effective lifting area than a wing of 7½-foot chord and 20-foot span (aspect ratio of about 2.7), although both wings have a surface of 150 square feet.

A high aspect ratio wing utilizes more undisturbed air, and at the same time the end losses due to the air leaking at the tips is proportionately lessened as the A. R. increases.

Now, although the wing most desirable, from an aerodynamic standpoint, is the one in which the span is great as compared with the chord, there are often structural considerations which do not make it advantageous for a very high aspect to be employed. Wings of high aspect must be built heavier than those of low aspect.

Longitudinal stability is more easily obtained with high aspect because the center of pressure (which shifts a certain per cent of the chord fore and aft on the wing in relation to changes in the incidence angle) travels proportionately less. This means a decreased tendency to pitch or "porpoise." On the other hand, a lower aspect is desirable where high speed and quick response to controls are sought; in fighting scouts, for example, where manoeuverability assumes greater importance than inherent stability and high lift.

From the foregoing considerations it will be easy to understand the reason for the high aspect noticeable in large bombing planes and commercial transports, in which heavy loads must be carried, in contrast with the light, quick, single-seater pursuit fighters and exhibition planes, which are designed to carry but very little load beyond their flying equipment.

The Little Rock Model Aero Club Formed

The first Model Aero Club to be organized in the state of Arkansas is the Little Rock Model Aero Club which was formed recently.

The Club intends to popularize and study the science of aviation through the medium of models. It is also intended to enter into the study of aerodynamics, especially as applied to heavier-than-air craft. It is expected that a good deal of enthusiasm for model work can be aroused, for at the present time indications are that such interest is rather lacking in that section of the country.

At the organization meeting held in December the following officers were elected: President, George W. Lescher; Associate President, S. E. Tanner; Vice-President and Treasurer, Emory McCook; Secretary, Wilcox B. Wild; Stock Clerk and Librarian, Emmett Darr.

The first model contest will be held in February and another in May.

As this new club is desirous of securing members in the region of Little Rock, those wishing to join are requested to communicate with the Little Rock Model Aero Club, 1813 West Seventh Street, Little Rock, Ark., care Mr. George W. Lescher, who will be glad to give full information and details concerning membership.

Proper Insignia for U. S. Aeroplanes

In building models, and particularly scale models of Army aeroplanes, it is desirable to finish them with the insignia and color markings denoting ownership by the United States Air Service.

During the War the official insignia consisted of three concentric circles, the outer one red, the center one blue and the disc in the middle, white.

Since the first of January, 1920, the insignia has been changed to that originally used before the War. This insignia is officially desccribd in a specification issued by the Air Service of the United States Army and is substantially as follows:

The design shall be a red circle inside of a five-pointed star, inside of a blue circumscribed circle. The circumference of the inner circle shall be tangent to the lines forming the pentagon made by connecting the inner points of the star. (This means that the edge of the inner circle shall not touch the inner points of the star by a clearance of 1/24 of the diameter of the outer circle.)

The inner circle shall be red, that portion of the star not covered by the inner circle shall be white, and that portion of the circumscribed circle not covered by the inner circle or star shall be blue. The colors should be the same shades as those in the American flag.

One insignia shall be placed on the upper surface of each npper wing in such a position that the outer circle shall touch the outer wing tip. One of these insignia shall be placed in a corresponding position on the lower surface of each lower wing. One point of each star shall be pointed diretcly forward.

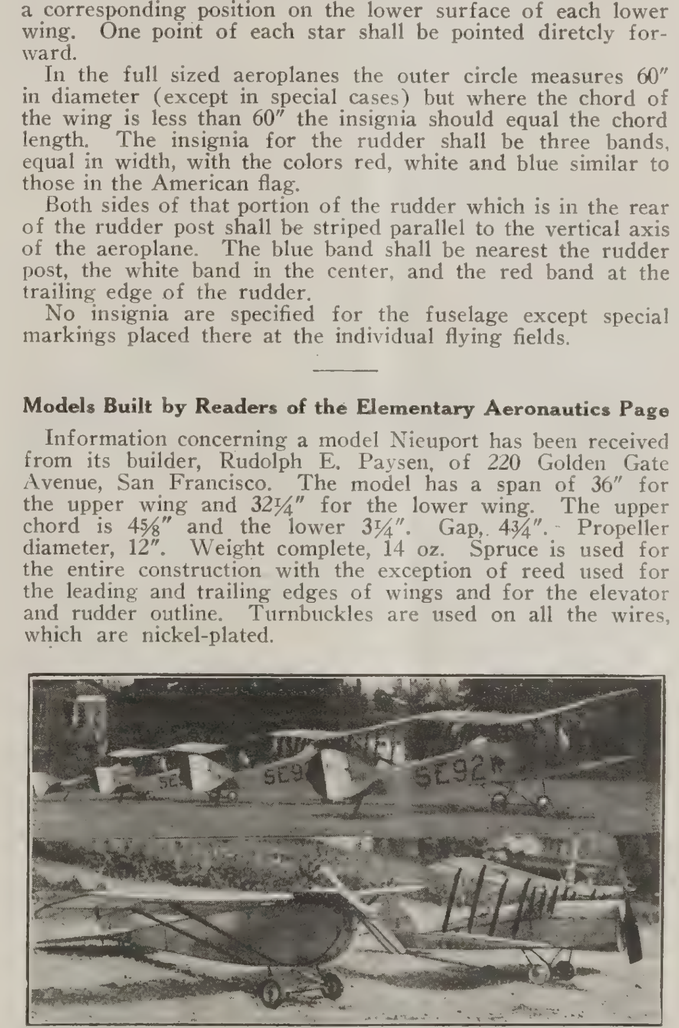
In the full sized aeroplanes the outer circle measures 60″ in diameter (except in special cases) but where the chord of the wing is less than 60″ the insignia should equal the chord length. The insignia for the rudder shall be three bands, equal in width, with the colors red, white and blue similar to those in the American flag.

Both sides of that portion of the rudder which is in the rear of the rudder post shall be striped parallel to the vertical axis of the aeroplane. The blue band shall be nearest the rudder post, the white band in the center, and the red band at the trailing edge of the rudder.

No insignia are specified for the fuselage except special markings placed there at the individual flying fields.

Models Built by Readers of the Elementary Aeronautics Page

Information concerning a model Nieuport has been received from its builder, Rudolph E. Paysen, of 220 Golden Gate Avenue, San Francisco. The model has a span of 36″ for the upper wing and 32¼″ for the lower wing. The upper chord is 4⅝″ and the lower 3¼″. Gap, 4¾″. Propeller diameter, 12″. Weight complete, 14 oz. Spruce is used for the entire construction with the exception of reed used for the leading and trailing edges of wings and for the elevator and rudder outline. Turnbuckles are used on all the wires, which are nickel-plated.



(Above) A Group of four Standard E 1 models built by C. J. Balassa; (below) Loening and De H. 4 models built by B. A. Mapes, both of Brooklyn, N. Y. Models made from AERIAL AGE plans

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

Life

Life is a "Tempest," but out of it we can make "A Winter's Tale" or "A Midsummer Night's Dream," "What You Will." It is not "As You Like It," but "A Comedy of Errors" in which we do not always receive "Measure for Measure," but "All's Well That Ends Well." —*F. A. C.*

Barnstorming

I.
We roamed with the old Canuck,
Adrift on the summer sky,
In the happy, reckless past,
Barnstorming days gone by.

II.
We filled up our tank with petrol,
And flew with the rudder free,
To the east or west or north or south,
From the Gulf to the western sea.

III.
The "God of fair winds" set our course,
And we wandered here and there,
And change and chance ruled in our hearts,
Two gypsies of the air.

IV.
Over the trails of the old Northwest,
Where my father's father came,
His household goods on a two-horse cart,
His rifle slung on a hame.

V.
Over the lakes and sparkling rivers,
Where the teal and mallard go,
When the south wind plays in springtime
On the frozen earth below.

VI.
We saw them all from the air,
By the drone of an O-X-5,
And we learned of the joy of living
In the joy of being alive.

VII.
We made us a bit in the going,
But we went for love of the game,
We went for the joy of roaming,
And not for money or fame.

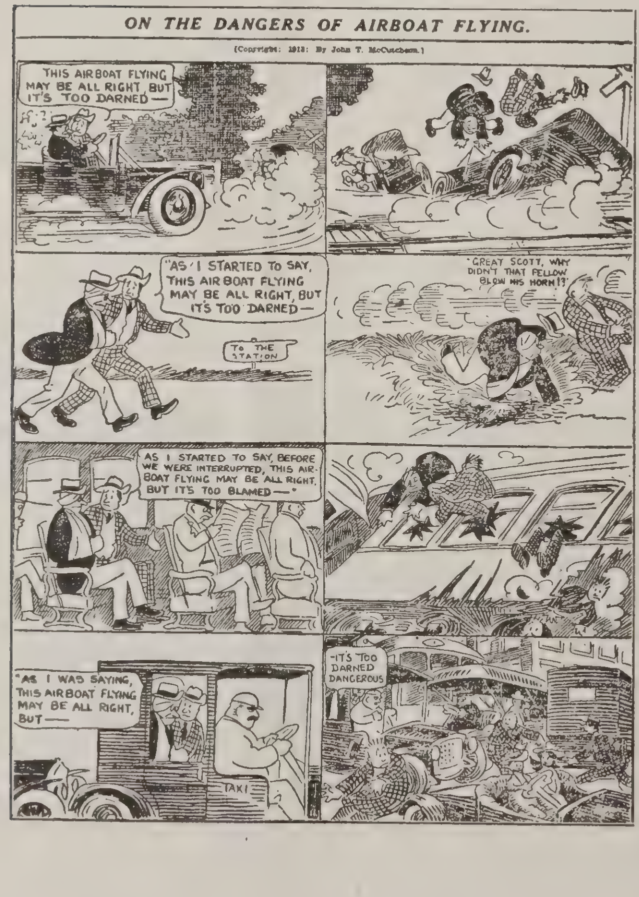
VIII.
Oh! the friends we made, and maids we loved,
In our travels thru the sky.
I wonder if they can remember
The Canuck and Billy and I.

IX.
If I thought they would remember,
I would surely rove again
On the course between the hamlets,
O'er river, lake and plain.

—*Lieut. Arthur S. Peirce.*

ON THE DANGERS OF AIRBOAT FLYING.

(Copyright: 1913: By John T. McCutcheon.)


THIS AIRBOAT FLYING MAY BE ALL RIGHT, BUT IT'S TOO DARNED —
"AS I STARTED TO SAY, THIS AIR BOAT FLYING MAY BE ALL RIGHT, BUT IT'S TOO DARNED —
TO THE STATION
"GREAT SCOTT, WHY DIDN'T THAT FELLOW BLOW HIS HORN!?"
AS I STARTED TO SAY, BEFORE WE WERE INTERRUPTED, THIS AIR-BOAT FLYING MAY BE ALL RIGHT, BUT IT'S TOO BLAMED —"
"AS I WAS SAYING, THIS AIRBOAT FLYING MAY BE ALL RIGHT, BUT —
TAXI
-IT'S TOO DARNED DANGEROUS

—And, Learn to Fly!

(Copyright(1920, by Charles L. Pryal.)

I wish to walk the Great Highway,
My legs to daily use;
I wish to breathe God's great outdoors—
Then, by some brook to snooze.

But, on the Great Highway I take
A chance of one in a million;
The horns do blow, the sirens scream,
As cars shoot by—a billion!

'Tis not like unto those boyhood days,
When rambling o'er the countryside,
The old "spring wagon's" dusty trail—
Now, when you walk, you'll lose your "hide."

'Twas then I "hooked" a ride behind the "rig,"
That down the dusty road swung long;
'Twas then I breathed the "gasless" country air,
And thrilled at the meadowlark's sweet song.

But now, what chance have I without a car—
Oh, yes—the roads are smooth and long;
But there's no room on the roads I walk—
Walk, if you will—you won't walk long.

So, my advice to human kind
Is, take a chance—my "prescription" try;
When you're crowded off the old, old road—
Fool 'em all, by gosh—and, Learn to Fly!

The Bitter Retort

Temperance Orator—When the rich man was in hell fire, what did he ask for? Did he ask for whisky? No! He asked for water. What does that show?

Voice—It shows where the teetotallers go.

Mapping the Aerial Routes

(Continued from page 493)

be based is expected to be completed within six months. The others are not expected to take so long for completion, as the work will be portioned to the various corps groups over the country, each group to do a given amount of work within its sectors.

The model route will lie in an air line direct between Washington, D. C., and Dayton, Ohio. The first thng that will be done will be to number all the towns along the way. All towns in each state will not be numbered, but certain ones at given intervals over the territory, perhaps twenty miles apart, will be so marked. The towns so numbered will then be asked to have this number, followed by the initial letter of the state in which it is, marked prominently on the ground in close proximity to the railroad station, and preferably on the lawn or roof of depot where possible. For instance, laid out in white cobblestones will be displayed, say, 10-P, standing, for example, for Harrisburg, Pa. With this done, a flyer can readily pick up the towns over which he should be flying, or, if lost in a fog, by flying low, follow railway to depot, pick up some number, then, with his map, easily right his course. This will be the first step in the work.

Next, flyers will make a photographic mosaic of the terrain over which the course lies. After this at each of the numbered towns will be made provisions for supplies, repairs, fuel, and communications. In short, the aviator on alighting may expect to find the same service which the autoist gets en route at designated points.

In addition to all of this, and one of the most important parts of the plan, will be the photographing from the air of each of the numbered towns. These photos, taken from the direction of approach by the flyer, would show the town just as though the aviator himself were looking at it from his machine. Across the photo would be drawn an arrow pointing graphically to the landing field. The reverse of the photo of the town would be a second picture showing the landing field. This would be done by fastening the two pictures back to back. Then, marked on this double photograph, would be all the data regarding the landing field and its features, whether smooth or tricky, how to avoid trouble in the event of unfavorable weather conditions, where to look out for obstacles, such as wires, or low fences, if any, where the supplies are, and all other available information.

These photos will form the key to the whole plan. With all the data marked on them, they will be formed into what is to be known as photographic file sections, each section covering a given territory. The photos will be specially thin, and compact, and the file will be so planned that it can be carried in the fuselage close to the pilot's hand, and instantly accessible. When all this has been done, a flyer desiring to go from a certain town to another across several states may go to any aviation post and secure a file section covering the route. The section will contain, in addition to the towns along the way, other maps of points in states both above and below the actual line of flight, so that should a flyer drift, or for other reasons detour, he will have at hand an accurate index of readily accessible landing points at prominent places so that he will never be really helpless in the air.

The value of this model route is expected to demonstrate itself readily. The one between Washington and Dayton was chosen for several reasons, one of them being that it is a difficult one. Several factors contribute to this latter condition. One is that the present route is not in a direct line and a considerable portion of it goes over an area in Pennsylvania in which are numerous industrial plants. Thus for miles flyers report that at times the ground is obscured by clouds of smoke over the whole country, in addition to atmospheric obscurities. It is important that speedy connections be maintained between these two points because the aviation headquarters are in Washington and at Dayton large aeroplane manufactories or potential manufactories are situated.

The distance by air is approximately 400 miles, and occupies from three and a half to five hours by plane, dependent on weather conditions.

Besides marking and photographing the way, it is planned to establish wireless stations at various points, so that an aviator may inquire by this method as to weather conditions at various points, and also keep in touch with ground points. Wireless amateurs are to be relied on largely for this service.

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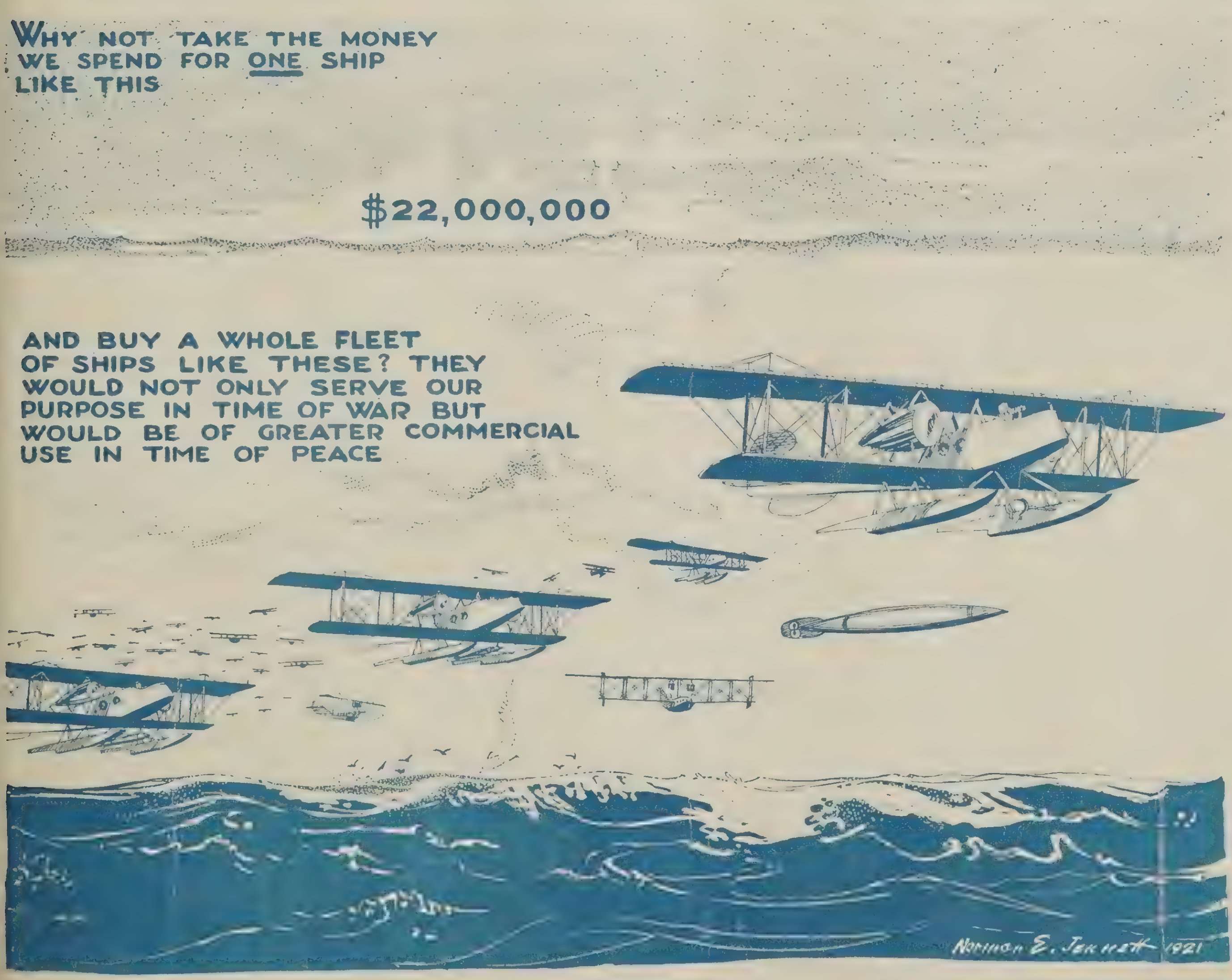
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Norman E. Jennett 1921

Will Congress See the Writing On the Wall?

A Naval Air Service

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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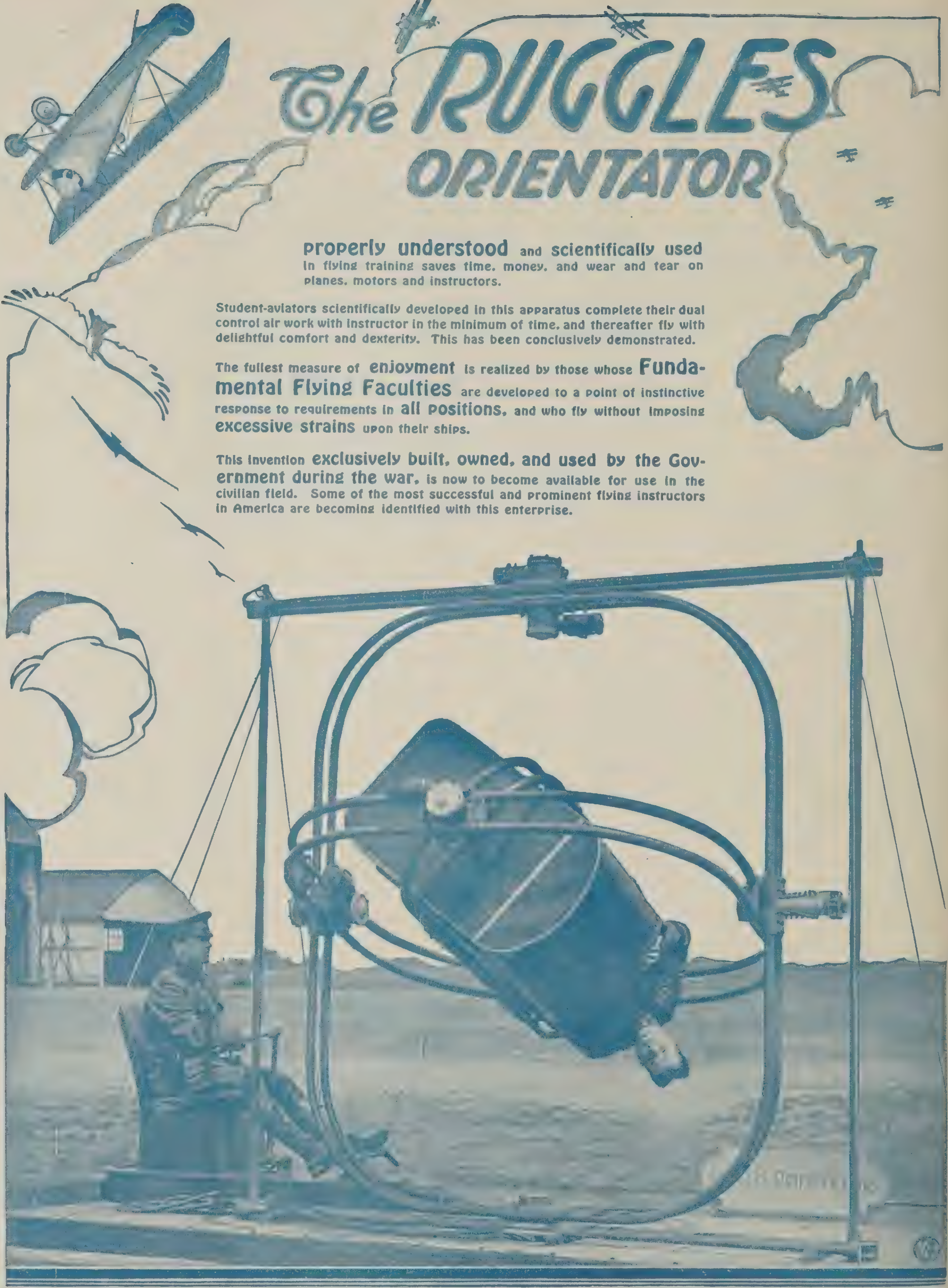

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A NAVAL AIR SERVICE

A THOROUGHLY equipped, well organized air service for the navy is imperatively demanded. The best authority in the United States on the subject makes the following estimate of the material for an adequate air force to co-operate with our battle fleet:

A

120 Torpedo and bombing planes, at $40,000	$4,800,000
70 Planes for long distance overseas scouting, at $40,000	2,800,000
97 Fighting planes, at $10,000	970,000
90 Spotting planes, at $12,000	1,080,000
6 Rigid dirigibles for long overseas reconnaissance, at $2,500,000	15,000,000
21 Non-rigids, at $100,000	2,100,000
50 Kite balloons, at $5,000	250,000
Total	$27,000,000

B

To provide hangars and shops, flying fields and other facilities necessary for operations and experimental work	$25,000,000

C

For maintenance	$10,000,000
Grand total	$62,000,000

It is to be noted that in order to maintain this number of planes from year to year, and to provide for progressive experimental work, Items A and C would have to be appropriated for yearly, $37,000,000.

Referring to this subject, an officer of high rank who has made an exhaustive study of modern naval warfare makes the following statement:

"If we had the strongest battleship fleet in the world it could not operate against any other country that is supplied with even a reasonable number of aeroplane carriers, with fighting and torpedo planes. There are no means of resisting an attack from the air except by air forces. The one having the control of the air over the field of action will be the first to get its torpedo planes against its enemy, and it is as easy to torpedo a battleship as it is to torpedo any other vessel. No reasonable number of battleships would be of any use to us unless they have their necessary auxiliaries."

This statement challenges contradiction. From abroad we have evidence of great improvements in Admiral Fiske's torpedo plane—its deadliness against battleships has been demonstrated.

Manifestly another necessary "auxiliary" of the battle fleet is the submarine force. The surface, the submarine and the air forces must be co-ordinated to form a modern fighting fleet —it means a three-plane navy.

If the 1916 building program is not revised to meet conditions in 1921, Congress will seemingly be responsible for spending more billions for a fleet that cannot fight successfully under modern war conditions on the sea.—*Editorial in N. Y. Tribune.*

Myron T. Herrick Assumes Presidency of the Aero Club of America

FOLLOWING the recent amalgamation of the American Flying Club and the Aero Club of America, under the name of this latter organization, comes the announcement of the election of Mr. Myron T. Herrick of Cleveland, O., former ambassador to France, to the presidency of the Aero Club of America.

Mr. Herrick has been interested in aviation since the early days of its development. He is one of our best known Americans, having to his credit a long life devoted in large part to the public service. He acted as Governor of Ohio from 1903 to 1906 and as our ambassador to France from 1912 on through the first trying months of the World War. He is an ex-president of the American Bankers' Association and was the first president of the Savings Bank Section of this organization. He is a trustee of the Carnegie Institute of Washington and is chairman of the American Committee for Devastated France.

In recognition of the great service rendered by Mr. Herrick, the Republic of France has conferred upon him the Grand Cross of the Legion of Honor.

Mr. Herrick brings to the presidency of the Aero Club of America the benefit of a broad experience in both national and international affairs, and, under his direction, will be carried forward an aggressive campaign for the strengthening of the Aero Club's national organization devoted to the furtherance of aeronautical development both for civil and national defense purposes.

Colonel Jefferson DeMont Thompson, who has acted as president of the Aero Club of America during the reorganization period, becomes chairman of the Board.

THE NEWS OF THE WEEK

12 Navy Seaplanes Finish 3,200 Miles

Panama.—Naval officers here are enthusiastic over the successful completion of the flight from San Diego, Cal., to the Canal Zone by twelve of the Navy F-5-L seaplanes, which arrived here on January 15.

The flight, which covered 3,200 miles and was completed in seventeen flying days, was marred by one fatality, Chief Radio Electrician Cain having been killed at Fonseca Bay, on the western coast of Central America, when he was struck by a propeller of one of the machines. The fliers encountered squalls in crossing the Gulf of Tehuantepec and got a severe shaking up.

The flight, which ranks well up among the longest on record, was over a course never before traversed by aircraft, and the aviators arrived here with a record of only one forced landing. Officials in charge of the squadron were enthusiastic in their praise of the Liberty motors with which the machines were equipped.

Starting from San Diego on December 30th, the seaplanes made nine stops—Bartolome Bay, Magdalena Bay, Banderas Bay, Acapulco, Salina Cruz, Fonseca Bay, Punta Arenas, Bahia Honda and Panama. Captain Henry C. Mustin, commanding the squadron, stated upon his arrival here that the flight was unique, since only two days were taken up with the preparatory work, while other long flights had been preceded by weeks, and even months, of preparation.

Supply steamers left San Diego only two days before the machines started and the journey was completed with only three main supply bases, a destroyer which was pressed into service having become partially disabled.

Commander J. H. Towers, a naval aviator who became famous when American seaplanes succeeded in crossing the Atlantic, became ill with appendicitis on board a supply ship which did not carry a doctor and received medical attention when a seaplane called by wireless carried a physician from another vessel to his ship.

The jump between Salina Cruz and Fonseca Bay, nearly 500 miles, was made by the fourteen machines without a stop, and was declared here to-day to be one of the noteworthy features of the expedition. The delay of the two machines which did not arrive with the main squadron was due, according to Captain Mustin, to underpower, these planes carrying only three motors, while the others carry four.

Appropriation Limits Aeronautic Research

Washington.—Aeronautical research will be restricted this year because of reduced appropriations passed by the House for the maintenance and operation of the National Advisory Committee for Aeronautics. A total of $405,266 was asked specifically for development of aeronautic power plant materials and aero dynamical research. The House appropriations committee and subsequently the whole House allowed only $260,000 for scientific inquiry and administrative expenses.

It is understood here that engineers and manufacturers interested in the promotion of the science of aeronautics intend to bring pressure to bear on the Senate in order to restore the original estimate for the advisory committee.

The estimate of $131,600 for power plant research prepared by the advisory committee was to be devoted to current problems with a view of reducing costs of engines, fuel and other maintenance charges which hinder the development of commercial aviation. The program also contained a provision for continuing the performance tests of new and improved aircraft engines and accessories.

$1,000,000 Asked to Fight Forest Fires

Washington—A million dollar Federal fund for fighting forest fires in co-operation with States was urged before a House subcommittee by more than a score of representatives of commercial organizations, forest conservation societies and others.

Gifford Pinchot, former Chief Forester of the United States, said the amount of wood used was increasing every year, and that with the constant loss by fire the problem of protection was one demanding prompt "help and solution."

The hearing was on the National Forestry Program Bill, which calls for the expenditure of $11,000,000 a year for the protection and development of forests, and was held before a subcommittee on appropriations.

Importance of the proposed legislation to the industries of the country cannot be over estimated, according to R. S. Kellogg, Chairman of the National Forest Program Committee.

The aerial forest patrol was so effective last summer that the subject is receiving careful consideration in the present discussion.

Aerial Development Urged for Vermont

Montpelier, Vt.—The early establishment of landing fields in Vermont to keep pace with the progress of aerial transportation was urged as a means of developing the State's resources in the inaugural address of Gov. James Hartness.

It was pointed out that in previous stages of transportation development Vermont had been handicapped by its lack of navigable rivers and the ruggedness of its surface, which made railroading difficult and costly, but that by taking timely action the State could be on even terms with others in air transportation.

"Our cost of road construction and our ever increasing cost of maintenance will more and more force us to use the airway, which is ready for use and costs nothing for maintenance," he said. "The future growth of towns will depend, in a large measure, upon the alertness in making provision for safe landings for aircraft. The landing fields are practically air ports. By the establishment of facilities of this kind our flying service will begin without further expense.

"I recommend an investigation of the needs of amending present statutes or enacting new statutes for facilitating the acquisition of landing sites by towns, or, under proper State or town control, of private initiative."

Glidden With Brokerage Company

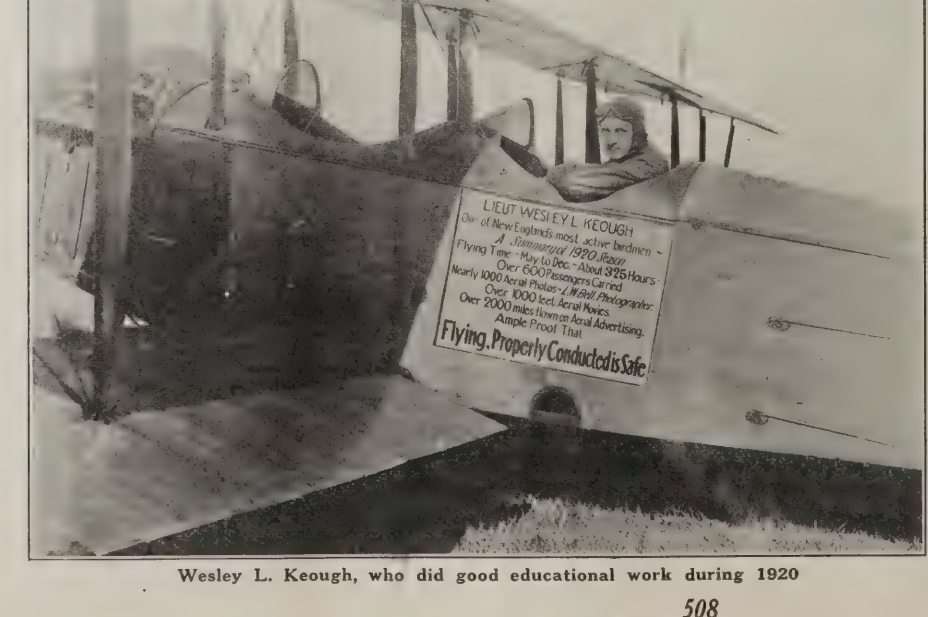
There was incorporated at Albany, N. Y., December 29th, the Ernest W. Kramer, Inc. Captain Ernest W. Kramer is president and treasurer; R. McL. Kramer, secretary, and Major Charles J. Glidden compose the board of directors.

The company is incorporated to do a general banking and brokerage business and will finance transportation and construction companies using aircraft and automobiles.

Texas Ranger Arrests Aviator

Galveston—Border smuggling Mexican bad men, and cattle rustlers are an old story to Texas rangers up and down the Rio Grande. Members of the force have demonstrated their quick wit and ready courage. Ranger Jackman, though, set a new record for the intrepid organization when he "pinched" a low flying aviator for disturbing the peace.

According to Jackman the aviator was juggling his plane up and down in a "disorderly manner," narrowly missing telephone wires and house tops. The ranger placed the airman under arrest when the latter brought his machine to earth in a nearby field.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Ample Proof That
Flying, Properly Conducted is Safe

Wesley L. Keough, who did good educational work during 1920

Newport News School Opens

The Curtiss Aeroplane & Motor Corporation have reopened their Flying School at Newport News, Va. Russell M. Simon, former Army Instructor, will be in charge of flying. Alex McKay will be in charge of service.

New Zealand to Model Air Mail On That of the United States

New York.—New Zealand will establish aerial mail routes along lines proven to be practical by the United States Post Office Department, according to J. B. Murphy, of Timaru, who is stopping at the Hotel Seville. Mr. Murphy is interested in an aircraft operating company in Timaru, one of the big cities of South Island, New Zealand. He came to New York for a demonstration of the ten-passenger Liberty-engined Curtiss "Eagle," with a view to utilizing it in a tourist sight-seeing service over Mt. Cook, which is the great objective point of tourists in New Zealand. He is already carrying passengers around the 13,000-foot peak in smaller machines, supplied to his company by the New Zealand government. The government is also encouraging civilian aeronautics by the enactment of laws and establishing landing fields. Mr. Murphy's company will operate out of Timaru between the cities of Christchurch, Dunedin and Invercargill, 400 miles in one direction and 100 miles in another. He has a contract to carry the aerial mails.

A South American Opportunity

American aircraft manufacturers will have an admirable opportunity of cultivating the Argentine market in March of this year, when the United States Manufacturers' Exposition will be held in the buildings and grounds of the "Sociedad Rural Argentina" in Palermo.

The manager of the Chamber of Commerce of the United States in the Argentine Republic assures us that there are many interests in our southern sister republic extremely interested in American aircraft and that it would be well for American manufacturers to get information concerning this exposition. George Hough Perry is in charge of the event.

Aviation Courses in California

Valuable educational work on flying has been taken up by a number of members of the Aero Club of Southern California. Hal R. Wells is lecturing to students in the Polytechnic high school of Los Angeles on the theory of flight and laying the foundation for a practical course on aeronautics in the Los Angeles schools. Dr. Ford A. Carpenter has developed a very valuable course of lectures at the University of Southern California, comprehending instruction in meteorology as well as in aeronautics. Emery H. Rogers and W. D. Waterman have qualified for teachers' certificates in order to establish aeronautical instruction in the Venice high schools.

Occidental College and the California Institute of Technology have both prepared courses which will aid students in preparing for qualifications as aeronautical engineers. The C. I. T. course is under the able direction of Prof. A. A. Merrill. Officers of the Aero Club of Southern California have addressed the Los Angeles Principals' Club and other teachers' organizations on flying topics.

Planes Go to Rescue of Ice-Bound Vessel

Tokyo.—A warship and several aeroplanes have been despatched to the relief of the ice-breaker "Baikal," which broke its moorings at Alexandrovsk, Siberia, during a storm on January 9. The "Baikal" was driven out of the harbor and surrounded by floating ice, and is reported to be frozen in the midst of an immense floe.

Sixty persons, including the crew and several passengers, are believed to be facing death from cold and starvation on board the "Baikal," and the last radio message received from the ship stated that those on board had abandoned hope. Navy officials, however, are confident that aeroplanes can quickly locate and bring relief to the ship.

Flying Boats to Patrol Coasts

Washington. — Flying boats, in large fleets, will be employed to patrol the Atlantic Coast, in life and ship saving operations, if the recommendation of Secretary of the Treasury Houston is approved by Congress. Mr. Houston told Congress experiments have fully demonstrated the value of aircraft as an adjunct of the United States Coast Guard.

Experiments discussed by Secretary Houston were made at the Coast Guard Aviation Station at Morehead City, N. C., the aircraft in use being the United States Navy HS flying boats. At the close of the war this station and equipment were turned over by the Navy. The establishment of other stations along the coast and the employment of regular fleets of flying boats to detect derelicts and to be used effectively in life saving is strongly urged upon Congress. Secretary Houston indicated a desire to appear before appropriation committees later in the session and advocate a liberal fund for the expanded service.

Checks Flying Stunting

Ottawa.—"Stunting" in civilian flying in Canada is being checked by an amendment to the air regulations. Henceforth no pilot of any flying machine, unless he is alone therein or has the written permission of his passenger, shall permit or cause such machine to spin, roll, loop or execute any other evolution involving unnecessary risks.

Miss Jessie Bradley, a student of the Ralph C. Diggins School, who soloed in 9½ hours. She will do exhibition work next season

$100,000,000 Pacific Navy Base Considered

Washington—Information regarding naval bases was given to a joint Congressional committee by Rear Admirals Mayo and Jackson of the general board and Rear Admiral Parks, chief of the Bureau of Yards and Docks.

Figures regarding costs of the various Pacific coast projects including a new general naval base in San Francisco Bay, and aviation, submarine and destroyer bases were presented. The San Francisco Bay projects, it was said, will cost between $80,000,000 and $100,000,000, with that of Mare Island somewhat lower. If the new base is not located at Mare Island, committee members said that $11,000,000 would be asked for the ensuing year's appropriation.

Aeroplanes May Help Climbers of Everest

Considerable interest is being displayed over the plan to climb Mount Everest. Alpine Club members are to carry out the actual climbing of the mountain while the Royal Geographical Society undertakes the scientific side of the expedition. Aeroplanes are being employed in the preliminary work of exploring routes, mapping the region, and locating rest camps.

The altitude of Mount Everest, estimated at 29,002 feet, is, of course, attainable by an aviator, but whether he could make a safe landing on the summit is another question. The assistance which the aeroplane can give to the mountaineers in their preliminary survey should, however, play an important part in helping them to achieve their ultimate objective.

Navy Testing Miniature Kite Balloon

The Navy is testing miniature kite balloons at the U. S. Naval Air Station, Pensacola, Fla. These balloons have a capacity of 6,000 cubic feet and are intended for aerological research work. They have expanding gores on their sides, to take care of the expansion due to altitude, instead of automatic valves. These miniature balloons will be flown from electric winches. Their purpose is to obtain records of wind, humidity and temperature aloft. They are designed to have sufficient free lift to carry the necessary aerological instruments and a light cable to about 5,000 feet. If successful under tests, these balloons will be flown astern vessels at sea, and used when the ordinary methods of obtaining aerological information fail.

Aerial Disturbers

An ordinance regulating flying over schools, hospitals and other immune points has been presented to the city council of Pasadena, Cal.

The ordinance will make it a misdemeanor for planes to fly within a certain distance of buildings marked with a white cross on their roofs, and certain restricted districts will probably be specified.

Personal Pars

Mayor John Inwood, formerly manager of the Inter-Allied Aircraft Corporation, is now president and general manager of the Liberty-Starters Corporation, with offices at 5 Columbus Circle, New York City.

Charles C. Gaines, lieutenant in the Air Service and well known among pilots throughout the United States, was accidently killed on January 4 while cleaning his shot gun.

The AIRCRAFT TRADE REVIEW

Navy Releases $4,000,000 Worth of Aircraft for Commercial Flying

New York—The largest aircraft transaction since the war was completed January 7th in the taking over by the Aeromarine Plane & Motor Company of $4,000,000 worth of Naval surplus aircraft and engines.

The release of this material, which is officially indicated by the Navy Department in Washington, marks the first step in the retirement of government surplus aircraft stocks, to the immediate benefit of commercial aeronautics.

Announcement of the deal was made by C. F. Redden, President of the Aeromarine Engineering & Sales Company. Included in the lot taken over are 125 H.S.-2 flying boats, equipped with the Liberty engine. These are in storage at Philadelphia and Brooklyn but will be transferred to the Aeromarine plant at Keyport, N. J., for conversion.

"In arranging for the distribution of these flying boats, the Navy Department," said Mr. Redden, "has two purposes in view. The immediate is to stimulate commercial flying and the ultimate is to build up throughout the United States a naval flying reserve.

"The situation in American aeronautics since the Armistice has been complicated by the fact that both the Army and the Navy have held in reserve the large stocks of aircraft which were on hand when the war ended. Naval Aviation has anticipated the release of equipment by the Army, as forecast several weeks ago, and has arranged with the Aeromarine company for the exclusive distribution of seaplanes and flying boats at prices which will make possible the entry of new interests into commercial flying.

"During the war Naval Aviation operated a flying coast patrol which was carried on with the developed H.S.-2 flying boats, equipped with Liberty engines. These boats are now made available at about one-third their cost. Numbers of them are being reconstructed into six-seat open-cockpit passenger boats and six-seat enclosed flying limousines.

"The Aeromarine company is in correspondence with commercial interests which desire to institute such flying services in various parts of the country as we have already established between Key West and West Indian ports. Our special desire is to place this equipment where it will develop the flying instinct and where expansion of operation will assure the training of additional seaplane pilots and mechanics to whom Naval Aviation can look for reserve personnel.

"That one of America's first lines of defense over land or water will be in the air is apparent to Naval and Military officers. To provide adequate national defense it is necessary to stimulate commercial aeronautics. Passenger and package carrying, of course, will provide the most general use to which these Naval aircraft can be put and the success of the Key West-Havana line indicates success for other routes, especially with the equipment available. Forest patrol, timber cruising, fish spotting and aerial photography are other lines for which the H.S. boats are particularly fitted.

"It was in recognition of the enterprise and activity of the Aeromarine Plane & Motor Company in reconstructing and operating other H.S. and F.-5-L flying boats that the Navy Department arranged for the exclusive distribution of its surplus."

National Aircraft Underwriters' Association Seeks Data

The National Aircraft Underwriters' Association, whose offices are at 132 Nassau Street, New York City, is endeavoring to obtain reliable data regarding the characteristics of the land over which aeroplanes fly along established air routes in this country. The Association would appreciate it very much if any pilots, who have flown extensively over most of the established air lines, would provide them with as much data as they can regarding the condition of the land over which they have had the opportunity to fly.

The reason for the Association wanting this data is that the different insurance companies who are affiliated with the Association, and are now writing aircraft insurance, are of the opinion that with this data at hand they would be able to judge more fairly what premium to charge to persons applying for coverage for different risks over different territories. To judge fairly what premium to charge, it is essential that the insurance companies shall know exactly the condition of the land over which the plane concerned is flying. If the reader is a pilot and has kept records of any flight that he has made, describing the land below, the Association will very much appreciate it if he will let them have a copy of this data.

Frisco Air Service

Jacuzzi Brothers, aeroplane manufacturers of Berkeley, are planning next spring to establish an air passenger service between Richmond, Oakland, San Francisco and Sacramento, it is announced through the Chamber of Commerce. It is proposed to put a six-passenger plane in this service and to maintain a regular schedule.

Cut in Air Mail Funds

Washington.—The Post Office Appropriation bill, carrying approximately $572,500,000, was passed today by the House after $1,250,000 for the air mail service during the coming year had been stricken out. Virtually no other change was made in the bill as reported.

Pulp People Full Out for Aeroplanes

Actual results achieved during the past summer in the use of flying boats for patrolling timber and pulpwood limits were outlined to the members of the woodland section of the Canadian Pulp and Paper Association at their annual convention. Planes were used during the year by the Laurentide, Spanish River and Price Bros. pulp and paper companies, and while the plan was something of an experiment the results secured were very satisfactory.

One use in which the air machines had proven advantageous was in patrolling the forests for the detection of incipient forest fires. All summer long the planes operated by the three companies coursed up and down over the great stretches of timber lands owned by these concerns, and proved a valuable aid in fire prevention.

The other principal use of the planes was in forest survey work. By means of the photographic devices developed during the war, miles of timber could be photographed in a day. These photographs, enlarged and pieced together, formed a satisfactory survey map of the territory covered. By the use of planes it was possible to complete surveys in a day which would have taken weeks by the old method of timber-cruising.

Plans a Canadian Flying Boat Line

Mr. Ericson, formerly chief engineer of the Imperial Munitions Board and now head of the Ericson Marine and Aircraft Company, Ltd., of Toronto, is in New York to confer with C. F. Redden, President of the Engineering and Sales Company of this city, and with United States Navy officials concerning the use of the American Navy Coast Patrol Aircraft in Hudson Bay transportation. Last summer the Canadian Government undertook to chart by air the region of Moose Factory. Mr. Ericson selected concerning the use of the American Navy Coast Patrol flying boats of the HS-2 type. Capt. Roy Maxwell of the Royal Air Force was the pilot and the party included Mr. Ericson, a Dominion geologist and representatives of the Canadian Aero Film Company of Toronto.

Mr. Ericson is organizing a commercial flying service between Great Slave Lake and Fort Norman in the McKenzie Basin of the Northwest Territory, and will use American Navy Coast Patrol flying boats. As equipped the flying boat will carry six passengers, a canoe, arms, ammunition, tent, food, cooking utensils, and, in fact, everything necessary for life in the wilderness.

Martin to Use New Rausie Engine

Springfield, O.—The Glenn L. Martin Aircraft Co. of Cleveland will equip one of its large commercial aeroplanes with a Rausie Big-Six engine of 250 horsepower. A new design of engine with four valves per cylinder and double cam-shafts will be submitted to the Government for the air mail service. This engine will be equipped with an electric starter.

Industry Urges Air Mail

Washington. — Manufacturers of aircraft and industry in general are making a determined fight here to induce the Senate to restore the appropriaton for the Air Mail Service which the House eliminated in passing the Post Office bill last week. The entire item was stricken from the House bill. The House Committee on Post Offices and Post Roads had recommended the appropriation of $1,250,000 or $2,250,000 less than the departmental estimates.

DESIGN OF RECORDING WIND TUNNEL BALANCES

By F. H. NORTON, Physicist

Aerodynamical Laboratory, N. A. C. A., Langley Field, Va.

THE following description of the design of a recording wind tunnel balance was prepared at the Langley Memorial Aeronautical Laboratory of the National Advisory Committee for Aeronautics, as the use of such a balance will greatly increase the efficiency of operation of a wind tunnel by increasing the capacity of the wind tunnel with a decrease in personnel.

Wind tunnel tests may be divided into two classes: commercial testing, where great accuracy is not important, but where rapidity of testing a more or less standard type of model is essential, and scientific work where the tests are of various kinds and accuracy is more important than speed. A balance for the first class of work need not be universal, but it should have a means for recording lift, drag and pitching moment, preferably plotting them continuously against angle of incidence. The second class of work demands a balance capable of supporting conveniently any type of model, and should hold them rigidly even at high speeds. All three moments and three forces on the model should if possible be recorded simultaneously and plotted either against angle of incidence or angle of yaw. It might seem that such an elaborate recording mechanism would be too great an expense, but when it is realized that it would save the time of three men, and would at least double the capacity of the tunnel there will be no doubt of its advantage.

The qualities desired in a scientific balance may be summarized as follows:

1. It should weigh all forces and moments simultaneously.
2. It should allow an incidence change through 360°.
3. It should allow the use of any type of spindle or wire support.
4. It should allow a yaw of ± 20°.
5. Forces and moments should be continuously recorded against angle of incidence.
6. Models should be easy to install and adjust.
7. Computations should be reduced to a minimum.
8. The weighing mechanism should be simple and positive.
9. The balance should be stiff enough to use at high speeds.
10. The balance should be simple and inexpensive to construct.

In order to choose the type of balance best suited for scientific work, the characteristics of the most successful balances will be considered.

The N. P. L. type of balance (Fig. 1) allows a ready adjustment of the angle of incidence, and the lift drag and moment readings are conveniently read. Its greatest disadvantage is the difficulty of supporting thin ended wings, or any model at high speed, and as moments and not forces are read, spindle corrections are difficult to make. It is also impossible to simultaneously read all forces and moments.

The wire balance as used at Göttingen (Fig. 2) has the advantage of being inexpensive and simple, but it does not allow large angular changes, and it is not universal.

The new Washington Navy Yard balance, working on the parallelogram principle, is the highest development in wind tunnel balances at the present time, and although it is self-balancing, it is not recording. The range of the angle of incidence is from + 90° to —90° with the usual set-up, and ± 360° by a special set-up.

After a careful study of the preceding types of balances had been made, it was decided that the most satisfactory arrangement would be a rigid ring completely surrounding the tunnel or wind stream, so that the model could be supported from it by wires or any arrangement of spindles. The forces and moments acting on this ring can then be recorded by suitable weighing apparatus.

A diagrammatic sketch for a balance of this type is shown in Fig. 3. The weight of the balance is supported on a long torsion wire, with a mercury or water float to carry most of the load, and the lift on the model is measured by a simple lever. The drag and pitching moment are measured by two arms connected to ball bearings at the upper and lower side of the ring. The difference of the weighings give the moment and their sum the drag. In the same way the cross-wind force and rolling moment are measured on two similar arms at right angles to the air stream. The yawing moment is measured at the bottom of the balance through a flexible joint. All weighing arms have corresponding counter weight arms to keep the systems in tension, and as the movement of

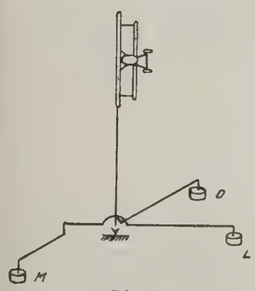


Fig. 1.

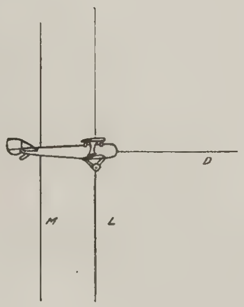


Fig. 2.

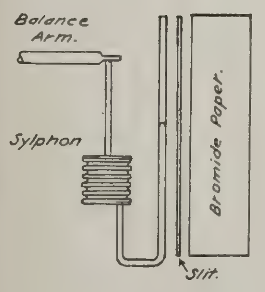


Fig. 4.

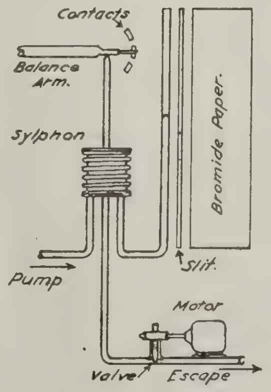
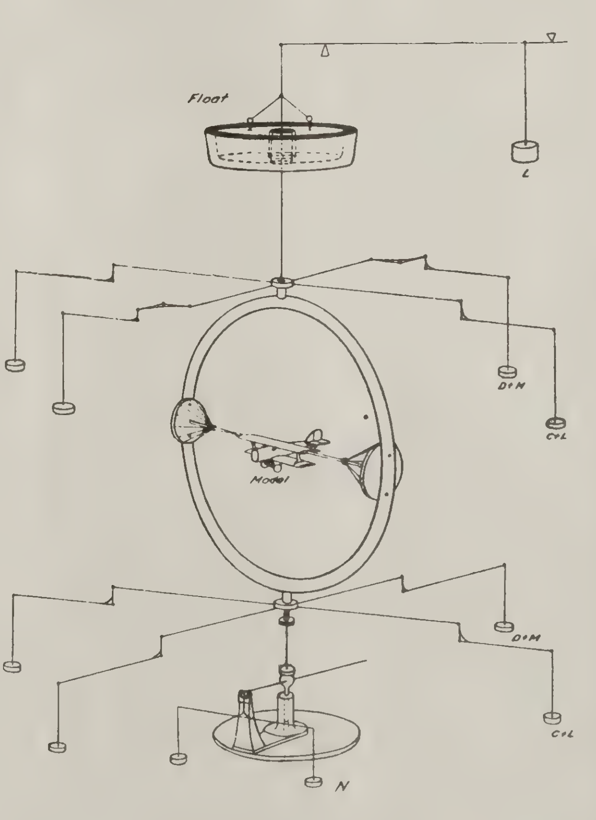


Fig. 5.



Assembly of Balance

Fig. 3.

the arms is restricted to a very small amount, the problem of stability does not arise.

The methods available for recording the forces on the arms consist of the following:

1. A motor-driven sliding weight, in the manner of a testing machine. This method requires the mounting of the recording drum on the balance arm, thus making it impossible to record the sum or difference of two weighings which, as will be shown later, is quite essential.
2. A spring or Toledo type of balance has been suggested, but the deflection required is much too large, as the arm should not have a movement of more than a few thousandths of an inch, or there will be interference between the different weighings, and the stability would have a serious effect.
3. The forces could be recorded by a mercury-filled sylphon as shown in Fig. 4. The pressure is recorded by the height of a mercury column, which covers a slit before a moving strip of bromide paper. Let us assume that the maximum pressure to be read is one kilo, with an accuracy of 1 gram. As the height of the mercury could be recorded to 1/10 mm., the total height would be 10 cm. Assuming that the area of the mercury column could be made as small as 4 sq. mm., the area of the sylphon would be 7.4 sq. cm. and its maximum deflection would be .5 mm. While this deflection would not be objectionable on some arms, it would be very much too large in most cases. This method is very simple and positive, but there would be considerable temperature correction which would be objectionable for recording work.
4. A more complicated fluid device is shown in Fig. 5 which will keep the deflection down to a very small value. The force on the arm is simply balanced by the fluid pressure in a sylphon or diaphram. The fluid is pumped through the chamber and its escape is regulated by an electrically controlled valve, operated by contacts on the balance arm, and the pressure in the chamber is recorded in the same way as before. This device would require considerable developing and would be rather expensive to construct.
5. The simplest and most satisfactory device is probably an adjustable chain weight as used in chemical balances (Fig. 6). This is simple, accurate and allows the recording pen to be easily attached. This method has been tested out and it is found that machine-made commercial chain is sufficiently uniform to give good results.

In Fig. 7 is shown a method of using this chain weight on a recording balance. One end of the chain is attached to the balance arm and the other to a slide driven up or down by a screw which is operated by a reversible electric motor. This motor receives its current through the contact points on the balance arm so that it will automatically balance the force. A pen is connected to the slider by a steel tape in order to reduce the motion, and this pen records the force on a drum which is driven synchronously with the model. It is possible to use a heavy enough chain to take care of all ordinary forces, but when runs are made at high speed, it will be necessary to add unit weights, and allow the instrument to rebalance.

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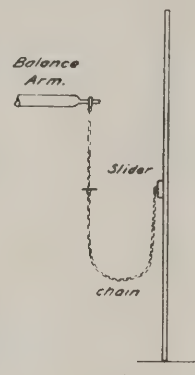


Fig. 6.

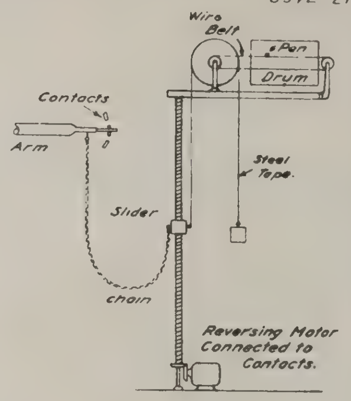


Fig. 7.

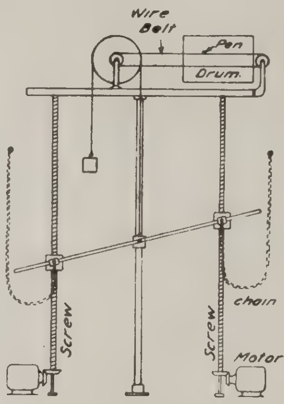


Fig. 8.

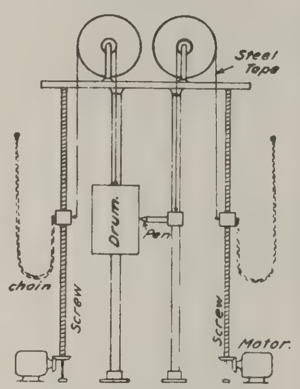


Fig. 9.

As it is very desirable to plot actual forces and moments, the former are obtained by mounting a pen on an equalizing bar so that the sum of the forces are recorded (Fig. 8), and the latter by mounting the drum on one slider and the pen on the other (Fig. 9) so that the difference of the forces are given.

In conclusion, the proposed type of balance will support the model rigidly in a variety of ways, will make a complete test without attention, and will plot the results so that all computations are avoided. While this balance is more expensive to construct than the usual type, it would certainly pay for itself in a short time by the large volume of work it could turn out and by the reduction in the wind tunnel pay roll.

AERONAUTIC INSTRUMENTS

By CHARLES E. MENDENHALL, Ph. D.

Professor of Physics, University of Wisconsin

THE number of instruments which are of use in aircraft is rather surprisingly large, and while this article must be limited to the consideration of a few of them it will nevertheless be instructive to give a fairly complete list in which the instruments are arranged in groups in accordance with their primary purpose, but not in the order of their importance. The method of mounting some of these instruments is shown in Fig. 1.

A. INSTRUMENTS FOR SHOWING CONDITION AND PERFORMANCE OF POWER PLANT

1. Tachometer.
2. Radiator thermometer.
3. Oil pressure gauge.
4. Air pressure gauge for gasoline system.
5. Gasoline level or supply indicator.

B. INSTRUMENTS FOR INDICATING OR MEASURING AEROPLANE PERFORMANCE

6. Altimeter. } Also used
7. Airspeed meter. } for navigation.
8. Angle of incidence meter.
9. Side slip indicator.
10. Rate of climb meter—statoscope.
11. Bubble or pendulum inclinometer.
12. Gyroscopic inclinometer.
13. Accelerometer.

C. NAVIGATIONAL INSTRUMENTS

14. Compass.
15. Turn indicator.
16. Watch.
17. Sextant.
18. Drift meter.
19. Bearing plate, etc.
20. Ground speed meter.
21. Stabilizing devices.
22. Wireless equipment.
23. Position indicator.
24. Night landing devices.
25. Oxygen apparatus.

D. INSTRUMENTS FOR MILITARY PURPOSES

26. Bombsights.
27. Gunsights.
28. Cameras.

It should be pointed out in the beginning that there are several especially adverse conditions accompanying the use of instruments on aeroplanes, which for some instruments become very serious indeed. These are excessive vibration, great and rapid change of temperature, large accelerations, and the necessity for keeping down weight and bulk. Other difficulties of a less general nature will be referred to from time to time.

Tachometer.—The most important engine instrument is the tachometer, because it first gives warning of improper functioning, and the most successful have been either of the chronometric or the centrifugal type. The former, which has been developed largely during the war, involves two distinct but interacting elements, *i. e.*, a time-measuring device or watch mechanism containing a spring-driven escapement, and a counting mechanism containing a hand or pointer moved by the drive from the engine through either a circular or linear rack. The hand is turned at a speed proportional to the engine speed for a fixed interval of time determined by the escapement. Hence the angle through which the hand is turned will be proportional to the engine speed. At the end of this motion the hand is locked in position, while the driving mechanism returns to the initial position and the cycle starts over again. If the engine speed is increasing the mechanism operating the hand will be turned farther during the next driving interval, and at the end of this interval the hand will be pushed ahead and again locked. If the speed is decreasing the hand will drop back, while if the speed is constant the hand will be again locked in the original position. Thus the cycle of operations consists of a driving interval, an interval during which the hand is adjusted to the new position of the driving mechanism, the locking of the hand, and the return of the driving mechanism to the zero position. In some instruments this complete cycle takes one second, in others two, the hand being reset each second or every two seconds as the case may be. The number of teeth on the rack of the driving mechanism which controls the position of the hand obviously determines the smallest interval to which the hand can respond, as the locking arm must engage one tooth or the next, but this can be easily made less than 5 per cent of the normal reading. The chief inherent difficulties of this type may be said to be liability to wear and breakage due to multiplicity of parts, many of which have to be continually started and stopped, and a tendency of the hand to jump back and forth through the interval determined by a rack tooth.

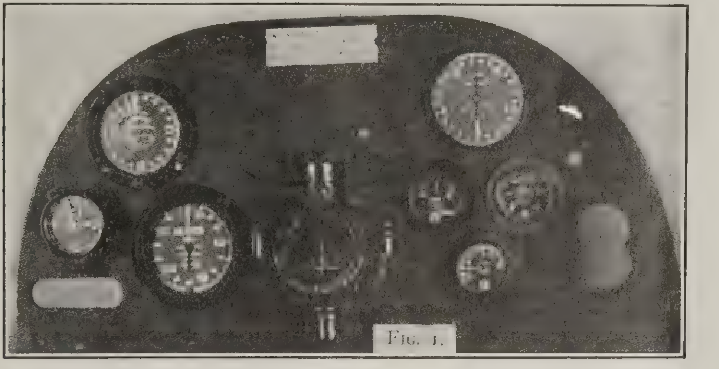


FIG. 1.

In 1917 there were two tachometers of this type in use abroad, the "Tel" having a relatively heavy and substantial mechanism, and the "Jaeger" built more like a clock or watch. Operating under the Tel patents the National Cash Register Company later produced many thousands of instruments for the Air Service, while a new and excellent instrument was designed by Mr. Prouty and produced in large numbers by the Van Sicklen Company. Fig. 2 shows the internal mechanism of the latter form. In 1918 the Hamilton Corporation completed the development of a third form which has one novel feature, namely, that the instrument is driven by air pulses produced by a compact reciprocating pump attached to the engine and transmitted through stiff-walled rubber tubing about ⅝" outside diameter. This question of drive is of particular importance in installations on large machines, in which it may take 35 feet or more of the usual flexible shafting, used with all mechanically-driven tachometers, to connect the engine with the indicating head on the instrument board. Such a length of flexible shaft, especially when very much bent, as will unavoidably be the case, has the disadvantage of absorbing very considerable power, of wearing rapidly, and of providing opportunity for the core or shaft proper to pull away from the end connections (which must be slip connections) unless the length of core is adjusted for the bends of each particular installation. For such cases the air-driven type is of considerable promise.

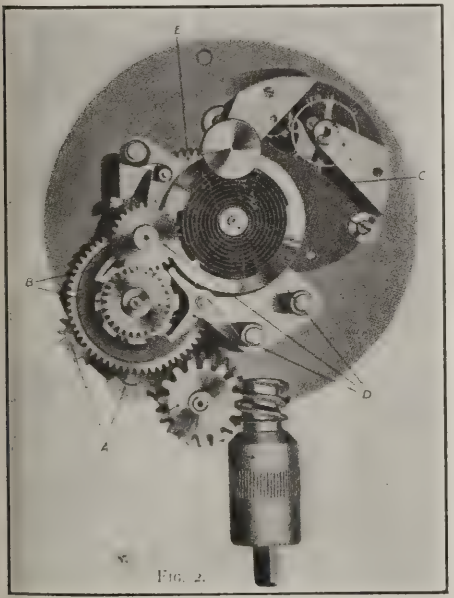


FIG. 2.

The centrifugal type of tachometer, the more common in ordinary use, has also been largely used for air work, both in this country and abroad, a number of types being developed for this purpose, some of most excellent performance. There may be mentioned the Jones, Reliance and Johns-Manville. An instrument of this type was developed in 1918 by Doctor Washburn of the Bureau of Standards, as the result of extended tests, but did not reach the production stage.

The chief inherent difficulties with tachometers in general are perhaps those of wear and lag (lost motion), both of which demand for their reduction good design, good workmanship and good materials. At first sight it might appear that the centrifugal type would give more nearly instantaneous readings than the chronometric, which responds only every one or two seconds, but such is not the case. Since its moving system has considerable inertia and rotates at high speed it requires an appreciable time to adjust itself. While this is a disadvantage in one way, it smooths over small fluctuations in speed and gives a steadier hand.

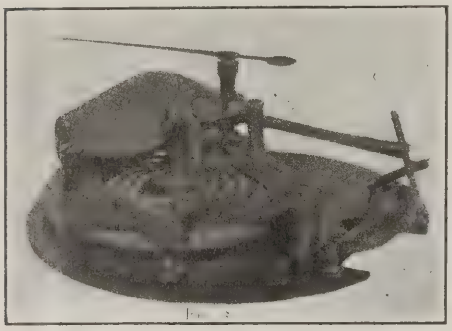
The very common magnetic type of tachometer has not been satisfactorily developed for air use; nor has the electric, though the latter offers some advantages in the case of long transmissions on large planes. Several air-viscosity types, and an airflow type were experimented with, but never brought to a production stage.

Radiator Thermometer.—The conditions of use here demand a distant-reading instrument, and two types are used. One involves a "bulb," containing a liquid whose saturated vapor pressure is transmitted through a tube to an indicating head or pressure gauge; the other a "bulb," connecting tube and pressure head, all filled with a liquid, whose relative expansion produces the pressure change which is measured. For the former type ethyl ether, sulphur dioxide, or methyl chloride, may be used, for the latter alcohol is commonly employed. In both cases temperature compensation of the pressure head is needed, while for the vapor pressure type the volumes of the bulb, tube, pressure head, and the amount of liquid must be so proportioned that the *meniscus* is always in the bulb, and hence is at the temperature to be measured. If there is too little liquid it may entirely evaporate from the bulb when the latter is the hottest part of the system, and if there is too much it may more than fill the bulb if this is the coldest part of the sysem, the meniscus being somewhere in the tube.

With the liquid-filled type, it is important that the volume of the tube and instrument should be small compared to that of the bulb, in order to reduce errors due to changes in volume of the former. Both types are subject to an error due to change in barometric pressure with height or otherwise, which is of course smaller the higher the internal pressures which are used. Thus an ether vapor pressure thermometer will at 20,000 feet indicate about 3° high, but this is not a serious matter; with a liquid-filled thermometer this error may be very much less. Since the purpose of the thermometer is to warn of overheating of the engine, and possible freezing of the cooling water, no great accuracy is required.

Oil and Air-pressure Gauges.—Since there is usually a forced circulation of lubricating oil, a simple pressure gauge will suffice to show whether the oil pump is functioning properly and the circulating pipes free, and the oil not too cold and viscous to flow properly. If, as is still commonly the case, the gasoline is fed by air pressure, a simple air-pressure gauge is provided to indicate when a proper air pressure is being maintained above the gasoline in the fuel tank. For military use, however, the pressure feed system was being displaced as rapidly as possible, because of the inherent danger: a puncture resulting in a particularly vigorous leak on account of the five or ten pounds' pressure which was used.

Gasoline Level Indicators.—A similar argument of increased danger applies against a certain type of gasoline level indicator which appeals to a physicist because of the simple application of hydrostatic principles. In this case a pressure gauge is connected to a tube extending to the bottom of the fuel tank; through this tube air is forced by a hand or power pump. Obviously the maximum air pressure which can be obtained is that necessary to force the air out against the pressure of the gasoline at the bottom of the tank. This pressure is of course proportional to the depth of gasoline, and the pressure gauge can be graduated to read inches of depth. By making the case of the instrument air-tight and connecting it to the top of the tank, the scheme may be adapted to a pressure feed system. Though this gauge was made and used to a certain extent in France, it has never been adopted in this country. The usual gauge is of the float type, and there are two rather troublesome problems involved: first, the design of a simple rugged float system which will not stick or jam, and, second, the transmission of the float motion, as is in some cases necessary, some considerable distance to the indicating head. When the latter is directly in the tank the problem is much simpler, and there are doubtless many mechanisms which will work, but it is equally true that many more have been designed which will not work. At least two fairly satisfactory ones were developed during the war—the Tanner and the Cole—the latter having a transmission system copied from an old-fashioned house bell; a similar transmission mechanism was also used by the Germans.



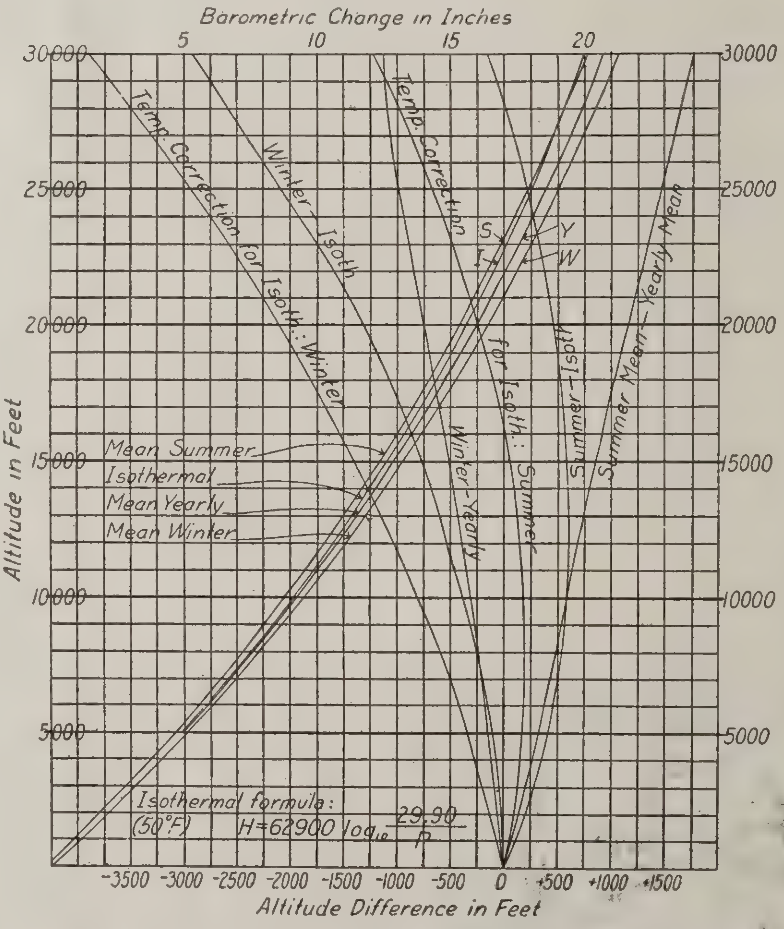
Altimeter.—This is of course merely the familiar aneroid barometer, the essential features (see Fig. 3) being a more or less perfectly exhausted flat metal box with corrugated elastic sides, one of which is rigidly attached to the case, the other moving as the external pressure changes. Various types of mechanism are used to magnify this motion, the ultimate result in our standard instruments being a complete rotation of the pointer for a change of pressure of about 4 cm. of mercury, corresponding to a height of 20,000 feet, with a uniform scale.

Since atmospheric pressure does not vary in simple inverse relation to altitude, the production of a uniform scale demands a specially designed mechanism involving either a cam, or more commonly levers, whose effective arms vary from point to point on the scale. The difficulties are of two sorts: First, those of the instrument considered as a pressure measuring device, and, second, those involved in the relation between pressure and height. Of the first class may be mentioned elastic after-effect, "sticking," and temperature error, of which the first is the most difficult to reduce. The restoring force which acts in opposition to the external pressure on the cell is due in part to the elastic forces of the cell itself and in part to an external or internal spring, which may be of the best quality of steel. The cell is usually made of nickel-silver, more subject to elastic after-effect; hence it is desirable to proportion the cell so that as much of the restoring force as possible may be due to the spring. A systematic study of the elastic properties of alloys suitable for cell construction, as a function of the composition and method of manufacture (heat treatment) was undertaken by the Bureau of Standards and the Air Service cooperatively, and has been continued by the former. The results of this may lead to considerable improvement.

The avoidance of "sticking" of the mechanism depends largely upon good workmanship and simplicity of design, while temperature compensation may be partly attained by imperfect exhaustion of the cell and by the introduction of an element into the mechanical train whose thermal expansion compensates the thermal-elastic changes of the spring and cell.

Granted the attainment of a satisfactory pressure-measuring instrument, there remains the calibration of it to indicate height. This is now universally carried out by means of the equation $H = 62900 \log_{10} \frac{29.90}{P}$ in which H = height in feet and P = atmospheric pressure in inches of mercury. This equation is based on the assumption of an isothermal atmosphere at 10° C., and the corresponding average humidity, and neglects the small variation of "g" with height. The assumption of an isothermal atmosphere is of course erroneous, and it is worth while considering the magnitude of the errors involved and the possibility of allowing for them, as well as the question whether a better basis for calibration could not be used.

FIG. 4.



The diagram (Fig. 4), based on computations of Lieutenant Waterman of the Army Meteorological Service, using data published in the *Monthly Weather Review*, January, 1918, by W. R. Cregg, shows the magnitude of the errors to be expected on the basis of the observed average summer, winter and yearly temperatures, with an instrument graduated on the usual isothermal basis. One may conclude from Fig. 4 and similar curves for spring and fall, that the error in fall, winter and spring would be very considerably less if altimeters were graduated in accordance with the yearly mean temperature distribution, while the errors in summer would be increased at high altitudes.

Aside from the *average* errors to which Fig. 4 refers, there are errors due to the departure of the temperature distribution from that assumed in calibration, whether this be the isothermal, as usually assumed, or the yearly or summer mean. Such variations from the mean are very common at lower altitudes, but are not likely to extend as high as 10,000 ft. Lieutenant Waterman concludes that the maximum error of this sort is perhaps —500 or —600 ft. at 3000 ft.

The only way of reducing the very considerable[1] temperature errors which are likely to occur with any fixed calibration (unless one used three separate dials, for summer, winter, and spring and fall) is by applying a temperature correction. If observations of air temperature are taken at the ground and at the maximum elevation, and better, at several intermediate levels as well, a correction may be taken from tables, such as have been published, for example, by the Bureau of Standards. In this way it is possible to reduce the outstanding error, as estimated by the Bureau of Standards, to one-half of 1 per cent. Since ground temperatures are subject to great local irregularities, it is the usual practice to observe at 5000 ft. and use the empirical relation $t_g = t_{5000} + 7°$ C., which is accurate enough for moderate temperatures. Some work has been done in England and is now being initiated in this country, upon the development of an instrument which would automatically correct to some extent for the main temperature error, by utilizing the temperature changes in the instrument during the climb, assuming that it took the temperature of the air at each level, or at least at the ground and the final height. This is a very interesting problem, and it would seem possible to make some progress toward a solution, but I have not heard of any final results.

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[1] It is obvious that the careful application of the temperature corrections is necessary in deciding as to all altitude "records." For a discussion of this aspect of the recent flights of Messrs. Rohlfs and Schroeder see *Science*, April 9, 1920.

The universal method of correcting for fluctuations in barometric pressure by having a rotating dial, which is always set to "zero" just before leaving the ground, is only approximate, since in general barometric fluctuations are not proportional to the pressure gradient at successive heights, but is good enough for daily changes, which are greatest near the earth. For a permanent shift, say to a higher landing field, the scheme of shifting the zero of a uniformly graduated dial makes the desired correction at all heights, in so far as the calibration of the instrument is itself correct.

Obviously the altimeter, because of inaccuracy and lag, is of no use in landing, except in a general way, but it gives an essential element in the determination of ground speed, for use in bomb-dropping, and as our knowledge of upper air currents increases, it will be used in locating favorable wind-levels, especially when flying above clouds.

Airspeed Meter.—The relative motion of an aeroplane with respect to the air is an essential factor in determining its stability, and the airspeed meter is used to determine the component of this motion parallel to the axis of the machine. This statement is really inaccurate and will now be corrected, for which purpose a digression is necessary. The motion of the plane through the air develops a complicated set of forces of which those on the struts, wires, side surfaces, etc., are in the line of motion, and of the nature of a resistance to motion (R), which varies approximately as the square of the speed, S, and as the density of the air. Besides these there are the forces on the wings and certain portions of the fusilage which, besides having resistance components parallel to the motion, also have large components perpendicular to this, the resultant of which is called the "lift" L, which also varies approximately as S^2d, where d is the density of the air. The remaining forces acting are the weight W, and the thrust of the propeller T. For certain values of W, T, R, and L, the plane will be capable of stable motion with uniform velocity. Since R and L vary approximately as S^2d, we may conclude that, assuming W and T fixed, corresponding conditions of motion at different altitudes will correspond to fixed values of S^2d.

Hence, it is desirable to have an instrument which gives, not a given reading for the same relative air speed at all heights, but one which gives the same reading for the same value of S^2d, at all heights. The actual air speed would then be proportional to observed speed over d. The particular conditions of motion which are of special importance to the aviator are: the best condition for climbing and gliding, most economical speed for level flying, and the stalling conditions, though the latter can be well enough determined by the "feel" of the ship.

For assistance in handling the plane, since true air speed is not desired, the most common instrument is either a pitot or a venturi tube, or the two combined, as shown in Fig. 5. These must be combined with an instrument for measuring pressure differences (see Fig. 6), consisting of a mechanical magnifying system and some sort of diaphragm; with the pitot tube, one side of this diaphragm is exposed to the "static" pressure, the other to the "impact" pressure, by air-tight tubes running from the "head" to the indicating instrument. In the case of the pitot-tube, theory (which is admittedly only fairly satisfactory) indicates that the pressure difference produced will be equal to S^2d, and this has been confirmed as regards the S^2 factor over a range of moderate speeds by observations with a whirling arm at the National Physical Laboratory, London. In fact, the pitot tube is at present the basic absolute standard for practically all airspeed measurements, both in the open and in wind tunnels. For high speeds (over 130 m.p.h.) a correction is required according to theory because of the compressibility of the air (see Buckingham 1st Rep. Am. Nat. Adv. Com. for Aeronautics), but further experimental research in this connection is desirable. The venturi tube produces a suction which, if the flow through the tube were non-turbulent and the compressibility of the air were negligible, would, according to Bernoulli's theorem, also satisfy the relation of $p_1 - p = KdS^2$. Unfortunately, neither of the above assumptions hold, so that the "theory" of the venturi tube is of no practical value except to indicate that probably the variation in proportion to d may be somewhere near the truth. The Bureau of Standards has recently obtained experimental evidence on this point. It is possible to design a venturi which will satisfy the S^2 law for a certain range of speed as was first done by Doctor Zahm. This was the first tube adopted by the Army. Later, Lieutenant Oliver and the writer, working at the Bureau of Standards, designed another tube which followed this law through a still wider range (up to 150 m.p.h.) and was only of one-half the size and had less than one-quarter the head resistance. This and the English standard Pitot are shown in Fig. 5, where *a* is the Venturi tube and *b* the corresponding impact opening, *c* the Pitot and *d* the static openings.

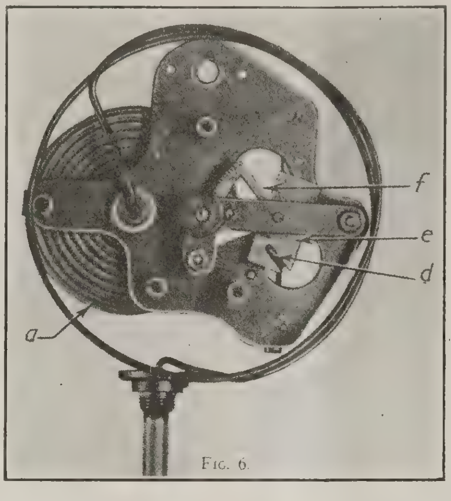

Fig. 6.

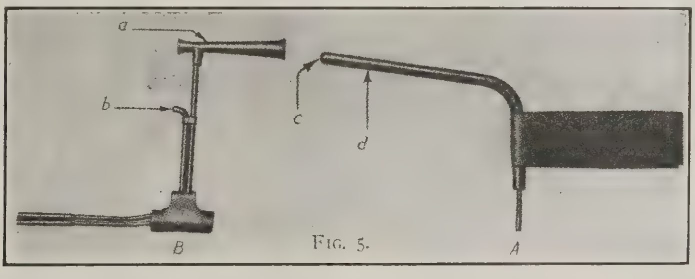

Fig. 5.

The pitot tube has the advantage of simplicity and ease of manufacture, since almost any sort of a forward-pointing tube will do. On the other hand, quantity production of the venturi-pitot combination, shown in Fig. 5, was found easily practicable, and since it can be made to give at least five times the pressure difference at any given speed, a more rugged pressure-measuring instrument may be used. It was for this reason that the venturi-pitot was adopted by our Air Service. For seaplane use it has the additional advantage of being less liable to plugging by splashing water.

In another form of airspeed indicator a plate is exposed normally to the air stream, held in position by a spring whose compression, due to the impact pressure, is indicated in a dial. If provided with a sufficient guard plate, at the cost of increased head resistance, such a plate will, as Zahm showed, give pressures agreeing with a pitot tube. Without a guard ring the agreement will be only approximate. Another form of instrument which must be mentioned consists of some form of screw or cup anemometer, whose speed of rotation may be indicated by some form of tachometer attached either directly, or else through electrical or mechanical transmission to the cockpit. This gives true and not effective air speed, and hence is not so convenient from the standpoint of handling the ship. On the other hand, for use in dead reckoning and for bomb-dropping its readings are what is wanted, while the readings of the other type of instrument must be corrected for altitude.

It should be emphasized that the location on the plane of the venturi or pitot tube, or plate or screw, is of great importance. The airflow is so much disturbed in the neighborhood of the wings that it is usually impossible to observe correct air speeds unless the tube or head is held several feet in advance of the leading wing and well away from the screw and fusilage. Such a position being impracticable in general on account of the increased head resistance of the mount, a "plane correction" should be determined for each type of plane and position of mount by speed-course trials. As regards use in handling the plane, absolute values are not needed, constancy of calibration being more important.

Angle of Attack Meter.—The angle of attack is the angle between a wing chord and the line of flight. For horizontal flight there is just one air speed possible for each angle of attack, hence the angle of attack has sometimes been used in place of air speed in handling the plane—notably by the Wrights. Since this angle is in general small, instruments have been designed for magnifying it and indicating it to the pilot, but have not come into much use. A string or tape whose end plays over a graduated arc is a simple but fairly effective device.

Side Slip Indicator.—One form of this consists of a small metal sphere provided with two small holes at the ends of the horizontal transverse diameter, which are connected (internally) with the two sides of a sensitive differential pressure indicator. If there is a side slip, that is, if the relative air stream is *not* normal to the transverse diameter, a pressure difference of one sign or the other will be produced. If the holes are at the ends of a vertical diameter the instrument becomes a form of angle of attack indicator. In neither capacity is the instrument much used.

(*To be concluded*)

THE DESIGN REQUIREMENTS OF COMMERCIAL AVIATION

By GROVER C. LOENING*

THE general expectations for aviation progress that are voiced by the press and many technical journals, and in discussions among aeronautical people, consist largely of hopes, predictions and an apparently fervent desire for many radical departures. For no other reason than a lack of patience, the public seems dissatisfied with aviation unless it is constantly confronted with some exciting revolutionary step, usually widely advertised as the final solution of practical aviation. The past year gives one particularly glaring instance of this in the entirely unwarranted prominence given to the "all-metal" aeroplane, and the innumerable editorial comments and other predictions usually made by people unfamiliar with aviation on how this development had solved the "problem."

Many of us must admit that we do not really know what the "problem" is. Aviation problems, like the battle of Jutland, still are being fought out in considerable of a fog. But when the metal aeroplanes burned up as readily as any other machines and showed many other important disadvantages, sentiment turned too quickly. For example, a prominent New York business man commented upon this development to the effect that, since metal aeroplanes had been proven unsafe, what was there left that aviation engineers could do? As a matter of fact, the difficulties encountered in the Junkers type of monoplane have, in my opinion, led to a situation where many of its very desirable advantages having nothing to do with its metal construction have been completely overlooked. I particularly refer to the excellence of its engine and its aerodynamic qualities.

There are many such instances in the progress of aviation in which an unexpected realization of a radical departure leads to a full swing of the pendulum which, however, is only short-lived; for, when this radical departure suddenly is found to have been more or less unwarranted, the pendulum sweeps completely the other way to a keen sense of disappointment. Both extremes are wrong; the departure usually has some merit and teaches a valuable lesson. The story of the automatic stabilizer is a pertinent instance of this; four or five years ago it also had solved the "problem." Editorials predicted how the sky would be black with aeroplanes a few months after the automatic stabilizer had been perfected. A few people then had the temerity to point out that until the automatic stabilizer had become an automatic "lander," it had no real value, particularly as it was rightly expected that the control and inherent stability of aeroplanes would improve greatly. On the other hand, the automatic stabilizer has a very definite and valuable use in connection with military aviation, particularly in bombing and navigating, although that is not the one for which it was originally intended. But, few automatic stabilizers are in use today commercially.

Because of the exaggeration of what these new departures will do at the start and the subsequent slump when they fail to meet their expected success, general appreciation by the public that successful aviation is here is tremendously damaged. If the public believes that aviation is impractical and unsafe as a general proposition, it is for the reason that it has been consistently educated to this point of view by aviation people themselves in their over-optimistic statements of what they think they can do. A plea for conservatism is realized now as being necessary to the successful prosecution of aviation. We must prove to the business man that we realize the time has come in the development of this art to stop "rainbow chasing." That is not only typical of commercial aviation, but it is even more evident in military and naval aviation; tactics are frequently evolved first and aeroplane constructors then are required to invent means of meeting them. The more practical basis would be to take what aeroplanes have been developed successfully and invent new kinds of tactics to make use of them. Tactics are easier to invent than aeroplanes.

Misdirected Aviation Development

On the basis of the experience we have had in the past two years the outstanding false leads that appear to have misdirected commercial aviation are as follows:

(1) The supposed advantage of huge multi-engined machines
(2) The unwarranted desire for slow-speed "buses" and slow landing
(3) The impractical applicability of war aeroplanes
(4) The unwarranted conception of the necessity of "all-metal" construction
(5) The mistaken thought that war aviation helped commercial aviation
(6) The too ambitious efforts to fly over bad country, and overselling

The arguments for multi-engined machines are generally known to all; if one engine stops, the other is supposed to keep the aeroplane going. As a matter of fact, in twin-engined machines having the engines out on the wings it has been found in the mail service that one of the most serious detriments to this type is that the engines stop nowadays more frequently from other causes than individual engine failure. For example, snow and frost on the engines disable both powerplants at the same time.

The use of multi-engined machines, in Europe, in comparison with single-engined machines, has disclosed no advantage. It has disclosed the serious fact that the machines are naturally larger, heavier and more cumbersome to handle on a field and much more expensive to operate. These difficulties are admittedly not as important in the large flying boat but, contrary to what was expected, all over the world the majority of new developments of commercial aeroplanes are single-engined machines. Obviously, the correct basis for consideration of this question is that presented by Frank Searle, who manages a London-to-Paris air line. He states that from the standpoint of reliability two engines are not better than one, simply because the one engine must be made absolutely reliable. Besides this, there is a totally mistaken idea in the mind of the public as to what causes engine failures on aeroplanes. It is very rare that the engine itself actually fails. Usually something fails in the gas line, a water line, or the like; so, the simpler and more direct installation of a signle-engined unit is very advantageous.

From the standpoint of expense in maintenance, which constitutes the big charge in running an air transport line, where the big multi-engined machines require 15 to 20 men as a ground crew to handle them, three or four of these men could handle in the same time as many single-engined machines as there are engines in the big machine. It must be admitted also that the most expensive part of an aeroplane is the engine. The engine and its installation have always been, in the experience of many, the major cause of expense in maintenance work. In looking into the desirability of these large aeroplanes, as compared with smaller and simpler ones, we should examine the very pertinent point as to the useful load carried per engine.

Table I presents a few figures on single and twin-engined aircraft; it is not in any way comprehensive, but indicates a very interesting result. In addition to the usual figures that have been given, a quantity entitled "useful load per horsepower" has been derived. It will be seen that even though the single-engined machines are largely related to war styles, with needlessly high safety factors, the fact remains that single-engined machines differ very slightly from multi-engined machines, all of those machines making about 110 m.p.h. and carrying somewhat around 4 lb. per h.p. of useful load. The figures differ, of course, with the slower machine. For example: for the Fokker V-45, which is slower than many of the others cited, the figures at least show that any claim for a tremendously greater efficiency for multi-engined machines in carrying useful loads is entirely unwarranted.

A question then arises from a practical standpoint. Given the expense of 100 engines would a commercial aviation company have a more flexible organization and be less liable to loss by crashes if these 100 engines are distributed to 100 smaller aeroplanes or 25 larger aeroplanes; the net tonnage carried per year being the same, but the number of pilots naturally being increased? I believe the latter increased expense is offset very quickly by the fact that the smaller ground crews required for the single-engined machines would be kept busy all the time handling one single-engined machine after another; whereas the much larger ground crew required to handle the larger machines cannot be kept so busy and must of necessity be waiting for the arrival, departure or repair of the fewer large units. We can at least conclude that the much advertised solution of commercial aviation by the use of large machines has not materialized, and that the use of these machines has, in fact, raised a very serious question as to whether they are anywhere near as cheap to operate as the smaller units.

Regarding slow speed and slow landing, a paper was presented before the Society two years ago in which it was maintained that the *raison d'être* of aviation is speed. This con-

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* Paper read before the Society of Automotive Engineers.

Table I—Useful Loads in Single and Twin-Engined Aeroplanes

Type	Single Engine	Twin Engines	Size h.p.	Weight Empty including Water, lb.	Useful Load at about 9 lb. per sq. Ft., lb.	High Speed m.p.h.	Useful Load per Horse-power including Fuel, lb.
Fokker, V-45	185 B.M.W.		250	2,640	1,540	93	6.15
Avro Triplane	6-cyl. Siddeley		245	2,460	1,220	96	4.97
Bristol Biplane	6-cyl. Siddeley		245	2,650	940	108	3.84
Westland, 6-seater	Napier Lion		450	3,823	1,736	118	3.85
Central Aircraft		Beardmore	354	4,996	2,250	89	6.30
Vickers, "Commercial"		Rolls-Royce	700	7,790	3,267	103	4.68
Martin, "Transport" at 9 lb. per sq. ft. of surface		Liberty	800	6,800	3,289	110	4.10
Handley-Page, W8		NapierLion	900	7,850	3,593	119	3.98

tinues to be the case, but at that time there was considerable argument to the effect that what aviation needed was not speed, but slow-speed "buses" that would lumber along in some old-fashioned way and were supposed to be desirable because they would be safer when landing. Slow speed does not always increase the safety of landing. This is particularly true of a machine that is very clean in design and speeds up fairly fast on a glide. If it is endowed with a low wing-loading in an effort to get a slow landing, it is likely to float interminably before it will actually stop rolling. To make slow landings high head resistance and low diving speed are needed, because the portion of a landing maneuver that uses up a field is the coasting of the aeroplane right near the ground, during the interval when it is endeavoring to stop flying and stick to the ground. At any rate, developments of recent machines have shown that a landing speed of 60 m.p.h. can be handled in a reasonable field, providing the machine slows up quickly after its wheels touch.

It is generally accepted now that the war types of aeroplanes are not commercially applicable as easily as was expected. The aeroplane structure part of these machines is built with a much higher safety factor than is needed for commercial use. This involves an increase in weight that is distinctly uneconomical for commercial flying. Aeroplanes of one-half the safety factor of most war machines could be flown with safety. War-type machines were not in any way designed with a view to weathering qualities and, particularly on those types of machine on which veneer is used in the engine bed, where this is likely to get soaked with oil, and where small fussy parts requiring adjustment are hidden away in the fuselage and threads of too fine a pitch are easily crossed when roughly handled, the commercial aeroplane company runs into expenses in upkeep that are entirely unwarranted and which before long more than make up for the original lower price of the machine.

The smaller types of war machine do not carry enough load to make their expense seriously worth while; the big machines are expensive, difficult to handle on a field and require expensive hangars. There are some types of naval flying boat that have been found distinctly useful, but principally because they require less alteration from a commercial standpoint in their installations. In the construction of war types of aeroplane, practically no thought was given to the protection of passengers and, above all, to the reduction of noise. Both of these features become of very great importance in commercial aviation, particularly the latter.

Are the engines used in war aeroplanes actually of a type at all suitable for commercial aviation? The lack of a muffler is by no means the most serious defect. The engines have generally such high compression that they bring with them endless spark-plug troubles. They are hard to start, difficult to cool and, particularly, full of minor carbureter and ignition difficulties. Many of their vital parts, such as the carburetor on the Liberty engine, are highly inaccessible locations and in many cases very dangerous from the standpoint of fire. The engines are in no sense commerical and were never designed as such. They, furthermore, possess several features calculated to give performance at great altitudes. These features are not useless by any means, but are certainly not fundamentals that must be met in commercial aviation.

The most important feature that causes difficulties in using war aeroplanes commercially is the generally amateurish and inaccessible installation of the power-plant. Vital gas lines, filters and connections are generally hidden in out-of-the-way places; they are hard to see and in many instances difficult to replace. The reason for this is merely lack of development; the time for the production of a machine was short and these innumerable small details did not have the commanding importance on a war aeroplane that they have in commercial work. Constructors the world over have realized the inapplicability of war aeroplane types, and are busy designing new ones.

There has been much cry about "all-metal" construction and, opposed to this, considerable talk about "all-wood" construction. There is only one kind of construction that is really correct for an aeroplane; it is an "all-simple" construction, whether it be of wood, metal, paper or rubber. One false lead that has deceived many people is that metal construction is easier on quantity production than any other type. Based on considerable experience in this kind of work, I venture to state that there is no more difficult type of construction for production in the small quantities in which aeroplanes are built than in metal, particularly "all-metal." The styles in aeroplanes, the load to be carried and the engines used, vary entirely too quickly to warrant the extremely expensive jigs and fixed equipment of tools needed to make metal construction economical. In adidtion, we have the serious situation today that metals are actually very hard to obtain, particularly in the light gauges used on aeroplanes. This applies not only to duralumin, but to many grades of steel and steel tubing. But there are very notable instances in the details of aeroplane construction in which the use of metal is apt to bring with it great simplification without increasing weight, and in almost every case this usually can be found in some part where a complicated metal fitting may be needed to take hold of a piece of wood. It is well known that the metal fittings are the expensive part of wooden aeroplane construction. When the wooden construction becomes more and more simplified, eliminating the number of small fittings, the necessity of metal construction becomes less urgent. It is possible to foresee in the general trend of development that the solution is a very judicious combination of the two, already reached in some new types of commercial aeroplane that have steel-tube fuselages and wooden wings.

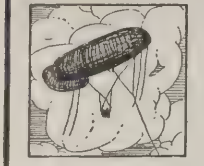
One of the general arguments presented in favor of metal construction is the increased weathering qualities to be obtained. This is distinctly a false lead. The deterioration of linen-covered wings is not at all great on the linen itself; evidence of this can be found in the experience of the United States Navy, which has kept a squadron of large twin-engined flying boats absolutely out in the open at sea without very serious damages, for months at a time. What deteriorates in this construction is not the linen so much as the light glued veneer parts inside the wing. When strained these are likely to open seams, thus letting in the weathering and gradually disintegrating the structure.

There is ample indication that, given proper wooden construction on the inside of wings, with all the parts large and solid and few in number, a linen-covered wing will have plenty of durability for commercial purposes, with a veneer-covered wing a close second. It cannot be said that the veneer-covered wing is superior to the linen, when the ease with which the linen can be replaced in perfect order every few months is considered.

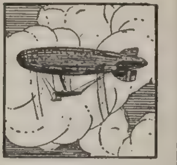
As for the metal covering of wings, what work has been done along this line has shown that the gauges of the metal are so light that an extended use of the machine soon starts it cracking at the seams. The rivets pull out of the thin metal. The result is that after extended flights one can shake a handful of rivets out of the all-metal wing. The entire structure when built of metal is rigid, which is exactly the condition that is not desired on a metal frame in an aeroplane, because, as it is, the vibrations of the engine are harmful enough in their crystallization influence. But when a metal framework is covered with linen, the linen supplies exactly that quality of deadening shock which is greatly to be desired and likely to extend enormously the resistance of the metal frame to crystallization.

It seems possible to conclude from a general survey of standard practice at the present time that it is distinctly desirable to build fuselages of steel tubing, and particularly safe to do so around the pilots and passengers because, in the event of a crash, the fuselage members will buckle without splintering. Furthermore, it is found that for the same strength a metal-frame wing, linen covered, is heavier than a wooden frame, linen covered, by so large a margin as not yet to have justified itself. Many other parts of the machine, such as the landing chassis and the engine-bed, have for a long time been built of metal on various machines with entire success. The framework of rudders and fins on a large majority of aeroplanes have been built of steel tubing for years, so that here is nothing particularly new in a partially metal construction and absolutely no conclusive reason for abandoning linen as a covering material. New methods of doping have made linen much more weatherproof, but when we add to that more recent developments in making this covering absolutely fireproof, it is likely to come back into its own as a remarkably strong and useful material, apt to survive as long as canvas does in sail-boats.

(To be continued)



FOREIGN TECHNICAL DIGEST



The Vickers Instructional Machine

The machine is a two-seater pusher biplane arranged for flying tuition preparatory to instruction on the "Vimy." A system of dual controls similar to that of the "Vimy" has been installed, the pupil being located at the front of the nacelle and the instructor close behind.

The cockpits have been arranged to reproduce "Vimy" conditions as far as possible, all necessary instruments and controls being provided both for pilot and pupil. The motor is started by the geared hand starter, which is operated from the rear cockpit.

Constituent Weights

Machine empty with water	2,950 lbs.
Petrol (39 gals.)	231 lbs.
Oil (6 gals.)	54 lbs.
Pilot and pupil	360 lbs.
Total weight	3,645 lbs.

General Dimensions

Overall length	32 ft. 4 in.
Overall height	12 ft. 4 in.
Overall span	47 ft. 8 in.
Chord of main planes	5 ft. 6 in.
Incidence of main planes	4½ deg.
Dihedral of main planes	4 deg.
Area of main planes	488 sq. ft.
Loading per sq. ft.	7.5 lb.
Loading per h.p. (360)	10.4 lb.

Performance

Full speed near ground	100 m.p.h.
Time to 6,000 ft.	8.25 mins.
Full speed at 6,000 ft.	97 m.p.h.
Service ceiling	13,000 ft.
Endurance at 2,000 ft. at 80 m.p.h.	2¾ hrs.
Landing speed	45 m.p.h.

(*Aeronautics*, December 23, 1920. 1 column, 1 illustration.)

Parachutes

This article deals with the theory and general practice pertaining to the development of the parachute and particularly discusses the experiments made by Garnerin and Dollfus. (*L'Air*, December 20, 1920. 2½ pages, 6 diagrams.)

The Staaken Biplane

This article describes the four-motored Staaken biplane and shows that the latest type is equipped with a turtle compressor for the maintenance of power at altitude. The gearing arrangement of the motors is of interest and is shown diagrammatically. (*L'Air*, December 20, 1920. 3 pages, 2 illustrations, 4 diagrams.)

The Metal Airscrew

This article by M. A. S. Riach, the British propeller authority, deals in general with metal airscrews and particularly refers to the experiments of Mr. Leitner and Dr. Watts in the development of the Leitner-Watts propeller.

The "Leitner-Watts" metal propellers have detachable blades, corresponding to a certain limited number of standards, and a number of separate standard metal hubs that can be bored to any engine shaft, and that are made to receive two, three or four blades. These blades are minutely adjustable through a wide range of pitch to suit the duty of the propeller on any individual engine or plane exactly—conditions of load and speed governing the employment of two, three or four standard blades. The blades are made so as to be easily fixed in a secure manner to the hub, so that the propeller can be packed in parts in a small space, and any blade damaged through any cause can be readily replaced from stock spares. The hub is a steel forging; the blades are hollow and built up of thin "pressed" laminated mild steel sheets, the number of laminations diminishing from the root of the blade towards the tip.

Two die forgings are made. The material chosen for these is mild steel to specification S.6, which is a medium carbon steel with an ultimate tensile strength of 35 tons per square inch, while that used for the blades is mild steel to specification S.3, which has an ultimate tensile strength of 26 tons per square inch. The dogs on the end of one half-sleeve are arranged to mesh with those on the opposite sleeve, and are so designed as to give the origin of the desired pitch. These meshing teeth are then edge-welded together; there is, of course, no stress on this weld, and the welding serves simply to ensure contact between the two halves. The blades of the propeller consist of mild steel plate, formed to the desired shape, and fixed to the center portion by edge-welding, further supported by a number of ribs, or driving bridges. These ribs are fixed in position by flush hivets and countersunk screws. (*Aeronautics*, December 23, 1920. 1¼ pages, 2 diagrams.)

Giant Caproni Hydro-Triplane

The hydro-triplane which is being built at the Caproni works at Turin is fitted with eight 400-h.p. Liberty motors. The three planes, it is stated, are 40 metres span, and fitted with ailerons. The eight motors are arranged in tandem, four at the front and four at the rear of the planes, and mounted in nacelles which are joined by false fuselages. The machine is fitted with an automatic stability device, and is controlled by a wheel, the working parts being fitted with ball bearings, so as to reduce the strain on the pilot to the minimum. An electrical signaling system is installed for communicating with the engineers. There is accommodation on board for ninety passengers. (*Aeronautics*, December 23, 1920.)

The German Airships L-64 and L-71

An article dealing with some of the more interesting points of construction of these vessels, which were handed over to Great Britain:

L-64, the older of the two, which was actually engaged in raids over London, has four gondolas equipped with 300-h.p. Maybach engines; L-71 has six gondolas similarly equipped. For the exhaust system a novel arrangement has been adopted whereby a large saving in weight is effected. Bolted to the exhaust ports is the exhaust manifold, which consists of mild steel pressings soldered together. Both manifold and exhaust pipe are entirely enclosed in an aluminium jacket, and the exhaust outlet, which is turned aft towards the propeller, is used to induce a strong draught of air through the space between the jacket and pipe, effectively cooling the system. (*Automobile Engineer*, November, 1920. 14 pages, 6 figures.)

The Development and Construction of the Caproni Aeroplanes

The author gives full details of the developments of the Caproni aeroplanes, and compares their characteristics and performances with German machines of similar construction.

The author illustrates and describes the various machines built by Caproni, beginning with the 100-h.p. Gnome-engined biplane, then the 100-h.p. Fiat-engined biplane, and the 150-h.p. Isotta Fraschini-engined biplane. He then deals with the successive three-engined designs of 200-300-h.p. up to 600-900-h.p. biplanes reconstructed for commercial use, and finally he describes at length the various triplanes built for commercial use up to 2,000 h.p. Tables are given showing the respective time of flight, fuel consumption, distance of flight and load-carrying capacity of the various types.

The author draws the conclusion that the cause of the relatively low carrying capacity is due to the fact that Caproni is aiming at a light net weight of machine and in order to achieve this requires many struts and a complex bracing system, which by greatly increasing resistance reduces the ratio of lift to resistance, resulting in smaller load-carrying capacity. The German designers rather prefer a greater net weight of the machine by strengthening the construction without the use of many struts and bracing wires, and thus increase the ratio of lift to resistance. (*Der Motorwagen*, September 20, 1920. 25 columns, 21 illustrations.)

Development of Aero-Engines Since 1914

In this series of articles both German and foreign practice is reviewed.

The differential engine of Siemens and Halske is claimed to mark the greatest development in rotary engine design yet produced. According to the author, aluminium pistons were fitted to the 260-h.p. Basse and Selve engines as early as 1916.

Aluminium is also favored for the cylinder block construction on account of the ease with which it can be worked. Reference is also made to electron, an alloy of high magnesium content, with which the Germans were experimenting at the time of the Armistice. This alloy has a density of only 1.8, and seems very suitable for crank-cases once the casting difficulties are overcome.

German aircraft engine construction was severely handicapped by the lack of suitable white metals for the bearings. Aluminium alloys only produced second-rate results. The absence of castor-oil was also felt severely in rotary work. Towards the end of the war the firm of Sonneborn produced a high viscosity mineral oil by adding to it a certain percentage of electrically polymerized animal or vegetable oil. This so-called Volto oil is stated to have given satisfactory results. (Dipl.-Ing. O. Schwager, *Illustrierte Flug-Welt*, July 7, 1920. 9 columns, 3 photographs.)

The Gastambide-Levasseur Wing

This article deals with the Gastambide-Levasseur Wing which was recently briefly described in AERIAL AGE, and the writer goes into detail as to what he regards the advantages and limitations of this particular form of construction. (*Illustrierte Flug-Welt*, December 22, 1920, 2 pages, 5 illustrations.)

NAVAL and MILITARY AERONAUTICS

Seaplanes Prove Their Value in Coast Artillery Practice in Philippines

Seaplanes prove their value as a main factor in the Coast Artillery target practices in observation work. The first day of the shoot from several of the batteries was arranged and carried out very successfully with Air Service Garrison Seaplanes and Balloon making observations and reporting all shots fired by radio to the Batteries.

The HS2L's seem to be more adaptable for observation work than the N9H's, although the latter were used to good advantage in connection with the practices.

Radio Gunnery and Photographic Classes at Fort Mills

The Radio Aerial Gunnery and Photographic classes consisting of the Second Aero Squadron enlisted men only, which is being conducted at the hangars, is progressing very rapidly; many of the men are well advanced in Radio, receiving and sending approximately fifteen words per minute, and the gunnery class is turning out some expert machine gunners.

The gunnery classes fired from the ground on the machine gun range, using both the Marlin and Lewis guns. The primary purpose of the target practice, however, was to test out all guns to be used on the ships.

The Longest Non-stop Flight in Philippine Islands

A record for the longest non-stop flight in the Philippines was made by Lieutenant Ira C. Eaker, Executive Officer, and Major Danielson, Department Construction Officer, November 7th. The plane, a DH-4, piloted by Lieutenant Eaker, left Manila at 8:12 a. m., and proceeded towards Corregidor, from there following the Marrarilus Mountains to Baguio, and after a little time spent in observation the return trip was made. Lieutenant Eaker landed in Manila after 3 hours and 21 minutes in the air.

General Nivelle Sees a Two-mile Line-up of Planes at Kelly Field

When the first sentry at Kelly Field saluted General Robert Georges Nivelle at 4:00 p. m., December 13, the word was passed to the waiting airmen, and as General Nivelle's car rounded Hangar No. 1, he saw a line of ships that stood wing to wing from Hangar No. 1 to No. 24. A line of SE-5's, DeHavilands, Fokkers, Spads, Curtiss, JN-6 Hg., Capronis and Handley Pages, every plane in working order with its crew and pilot lined up in front.

The General rode down the entire line. When he returned to the reviewing stand the word of command was given and the big line of pilots and mechanics simultaneously broke, and from Hangar No. 1 the bark of a single SE was the signal for the entire line of ships to "come to life," and they did. Three minutes later there was not a single dead motor on the line, and the First Pursuit Formation was already out on the field ready to take off. They were followed by three other SE Formations; then the DeHavilands rounded off. The Formation circled the field and passed over the reviewing stand. The highest Formation was 2,000 feet; the lowest 500.

There was a typical Texas Norther in action, with a 35-mile wind on the ground, and naturally it was a little bumpy.

The A. S. M. S. contributed pilots to a Pursuit and Bombing Formation. Both Formations were low and close and the Mechanics School men showed that, though they were supposed to be more familiar with the monkey wrench than the Joy stick, when occasion demanded they could handle both in a more than passing manner.

After the exhibition a tea was given at the Aviation Club in honor of the General. All officers of both fields were present. The General was very much pleased with his afternoon at the field.

Unique Photographic Flight at France Field

A unique photographic flight was made during the week of the 11th of December by Capt. Thomas Boland and Corp. Claude W. Carson. In a plane remodelled to use a K-1 camera, a flight was made during which 80 photographs were taken which will constitute a mosaic from the Atlantic to the Pacific Oceans. The 12th Photo Section has practically completed the work on these exposures and the results promise to be the best which have ever been obtained here.

Fire Patrol at Camp Benning

The military reservation at Camp Benning, covering an area of 97,000 acres, a greater portion of which is covered with weeds or heavy underbrush. During the period from November 1st to December 10th, little or no rain had fallen in this vicinity. Due to ease in which fires were started and the rapidity in which they grow in intensity and the great distance from the headquarters of the Fire Department, it was suggested to the Executive Officer that the Aeroplane Detachment at this station be allowed to run fire patrols daily for the purpose of reporting forest fires.

Under authority of letter from the Camp Executive Officer, a daily Forest Patrol covering the entire reservation and adjoining forests was started by this detachment on November 4th, 1920.

Patrol is flown daily between the hours of 9:00 and 10:00 a. m., with the exception of Saturday and Sunday. One officer as observer making notation as to actual location of fires and wirelessing position by coordinance to Detachment Radio Station. Should fires be located, upon patrol's return they are accurately located on maps, and positions phoned to Camp Executive Officer. The wireless being used only for the purpose of training of observer and radio detail.

To date, four fires have been reported, all of which have failed to be noticed by ground patrols located on the reservation.

Total number of patrols, 18; total time of patrols, 13 hours 10 minutes.

75 Planes Make 354 Flights at March Field

Seventy-five ships made 354 flights from the local flying field during the past week. Total time, 243 hrs. 45 min.; approximate mileage, 13,882. Preliminary instruction required, 160 hrs. 5 min.; advance instruction, 28 hrs. 50 min.; test flights, 9 hrs. 20 min., and miscellaneous flights, 12 hrs. 30 min.

Across the United States in a Day

The Chief of Air Service, U. S. Army, officially announces that on February 22, 1921, an attempt will be made to cross the United States by aeroplane within a period of 24 hours.

The route chosen extends between Florida and Southern California. The starting point in Florida will be Pablo Beach, Jacksonville, and the starting point in Southern California will be San Diego. The former point is within the 8th Corps Area and the latter point is within the 9th Corps Area. The distance flown will be 2,079 miles. There will be two participants in this flight. Lieut. Alexander Pearson, Jr., will take off from Pablo Beach, Florida, making the flight in three hops; from Jacksonville, Florida, to Ellington Field, Houston, Texas, 804 miles; from Ellington Field to El Paso, Texas, 660 miles; from El Paso to Rockwell Field, San Diego, Calif., 615 miles. The participant from San Diego, whose name has not been announced, will reverse this schedule, making the flight on the same day.

It is believed that this flight will produce records of performance which will be of extreme interest in the furtherance of both commercial and military aeronautics and will be the first in history in which the United States has been completely traversed in so short a period of time.

U. S. Aviators Entering Canada Must Regard Canadian Air Regulations

Attention of the Chief of Air Service has been officially called to the fact that aviators entering Canada from the United States are in the habit of disregarding Canadian Air Regulations of 1920. These regulations provide that machines entering Canada must be registered in the United States; that their pilots must be duly qualified military pilots and that they must not carry passengers for hire between points both of which are in Canada.

Since all Air Service personnel must obtain authority to fly outside the limits of the United States before embarking upon a flight, it is believed that the infringement of the laws referred to comes from civilian fliers, who, no doubt, may not be aware of the Canadian air regulations.

Under present legislation there is no governmental agency in the United States charged with the control of aerial traffic nor is there any machinery in existence for promulgating information to aviators out of service.

FOREIGN NEWS

Flights Over Battlefields Planned for Next Spring

Thomas Cook and Son are reported to be making arrangements for aeroplane tours round the battlefields in the coming tourist season.

The following tours are proposed:—

(1) From Paris via Compiegne, St. Quentin, Cambrai, Douai to Lille. Land at Lille for lunch. Return to Paris via Arras, Albert, Montdidier. Proposed charge, 800-850 francs.

(2) From Paris to Chateau-Thierry, thence to Reims, returning by Craonne and Soissons. This tour could either be made in one continuous circular flight, or with a stop at Reims. Proposed charge, 650 francs.

These tours would not be run on fixed dates, but only when a group of four or eight intending tourists had been obtained.

The Messageries Aeriennes will probablye have an aeroplane (six-seater) service from Paris to Verdun and back, the fare for the return trip with descent and short stay at Verdun will probably be about 700 francs per passenger (minimum of five persons). In connection with this Thomas Cook and Son will probably arrange an inclusive excursion providing, in addition to the flight, automobile transport between the aerodromes and the two cities. Cars may also be provided for visits to the Verdun forts, etc.

Flying in South Africa

Mr. Basil Reunert, of Airflights, Ltd., has some interesting things to say about Major Honnet and his experiences in flying in the country districts. They have been flying for the past few weeks in the Transkei—around Umtata, Butterworth, and St. John's, and have been doing excellent business in these country towns. At St. John's, Mr. Reunert, says, the landing is exceptionally difficult, as the machines have to be piloted through two cliffs about 1,200 feet high and only 150 yards apart. Traveling through these cliffs is very bumpy. Major Honnet has demonstrated to the whaling station at Durban the use of aeroplanes for "whale spotting," and took Commander Hean up with him. They spotted four whales, and Commander Hean thought it was an excellent idea.

Foch Gives Figures on German Aircraft

Marshal Foch's report on disarmament and demobilization in Germany points to a resumption of aerial activities, showing that the German Government declines to yield to the decision of the Boulogne ocnference and refuses to cease building aerial materials.

"Many machines were surrendered to the Allies," his report says, "including 26,822 aero motors, which were 90 per cent. of the total German motors; 13,000 aeroplanes and hydroaeroplanes, which was 92 per cent. of the total, and six dirigibles.

"But the Control Commission has discovered important hidden stocks.

"These include 7,930 aeroplane motors, 281 aeroplanes and hydroaeroplanes, and a large number of aeroplane parts.

"There still exists a considerable quantity of carefully hidden aerial material, but we cannot fix the exact amount.

"The German Government recognizes the existence of hidden material and declared itself to pass a new law to render declaration of this material obligatory. Twenty per cent. of the aero hangars have been destroyed.

"About 5,000 aeroplane machine guns have been surrendered to the Allies.

"These fresh infractions of the decisions of the Boulogne conference have been observed:

"Junker factories have built 150 civilian aeroplanes. Fokker factories have built three, with one under construction. L. V. G. factories are building a new type of hydroaeroplane. The Wablating factory is building three aeroplanes.

"Eleven aeroplanes have been discovered under construction privately in Hamburg.

"The German Government refuses to surrender spare parts of Zeppelins under the pretense they were built in 1919 for civilian dirigibles."

Aero Engines Stand Strenuous Test

The Napier 450 H.P. "Lion" which recently gained for Vickers, Handley-Page, and Westland Aircraft the Highest Prizes in each of the 3 classes in the British Air Ministry Competitions, has just completed another strenuous and exhaustive test.

For 50 hours the engine was run, after which it was put to a further 5 hours' test at the following rate:—

High Speed Test of....1 hour @ 2,300 revs. per min. @ 352 B.H.P.
High Power Test of....1 hour @ 2,100 revs. per min. @ 454.5 B.H.P.
High Power Test of....1 hour @ 2,015 revs. per min. @ 457 B.H.P.
High Power Test of....1 hour @ 2,225 revs. per min. @ 532 B.H.P.
High Power Test of....1 hour @ 2,026 revs. per min. @ 490 B.H.P.

From this it will be seen that the engine was run at the remarkably high H.P. of 531, which is a wonderful performance for an engine built to develop 450 H.P.

Aerial Mails in New Zealand

With the New Year, New Zealand will commence its first aerial mail services between Christchurch and Timaru (South Island), and Auckland and Whangarei (North Island) according to information received by the High Commissioner for New Zealand.

French Air Attachés

It is announced that France is to be represented in the principal countries of the world by Air Attachés, as well as by Naval and Military Attachés.

French Aeroplanes for Roumania

It has been reported from Bucharest that, as the result of negotiations that have been taking place between the French and Roumanian Ministries of War, an agreement has been arrived at whereby France will deliver to Roumania aeroplanes and an important quantity of aviation material.

Roumania will, in return, permit a large amount of petrol and petroleum to be exported to France.

New Aerodrome for Burma

The Burma Government has notified its intention of acquiring forthwith an area of 113 acres in Thayet-myo Cantonment for the erection of an aerodrome.

Italian Protest Against Government Apathy

As a protest against the Government's apathy, and to urge the necessity for a more energetic aeronautical policy, a large number of Italian airmen and university students bearing posters paraded Rome in motor lorries. The public seemed to sympathize with the manifestation, but it is feared that the Government will not be roused to action.

Oil Rush by Aeroplane

It has been reported in the *Financial News* that Alberta is preparing for a rush by aeroplane to the new petroleum fields near Fort Norman, on the MacKenzie River, 900 miles north of Edmonton, which has been heralded by the Dominion surveyors to be richer than the oil lands of California.

Negotiations are already under way for the establishment of an aerial service out of Edmonton, with landing stages along the route, supplied with food and fuel for prospectors and their machines.

A Proposed Aerial Service

According to the *Motor Weekly,* of Bloemfontein, a scheme for an air service to embrace the whole of the Union of South Africa has so far progressed that a company is at present in course of registration in London. It is proposed to carry passengers, mails and freight, although the original scheme was to carry mails and parcels only.

Aviation in South Africa

There is every reason to believe, states the Johannesburg correspondent of *Modern Transport,* that in the near future aerial mail as well as fast passenger services will be established between the larger centres of population in the Union of South Africa. The past twelve months have been attended by numerous handicaps. A Customs duty of 17 per cent. was levied on the entry of machines and their component parts, and it is only recently that this impost has been altered to advantage. Furthermore, pioneer work had to be undertaken, although it may be added that flying in South Africa has, so far, been remarkably free from accidents. The appointment of a Civil Air Board by the South African Government, pending legislation which is now being drafted, has been received with general satisfaction throughout the country. The Board will deal with such matters connected with civil aviation or aerial services as may be referred to it by the Government, and advise upon all matters of general policy affecting civil aviation, more particularly upon the following matters: (*a*) Legislation and regulations; (*b*) the development of aeronautics in South Africa; (*c*) the proposals for the establishment of aerial mail and passenger services within the Union and adjoining territories; and such other matters as may be referred to it by the Government.

The "Airco" Service Stops

The "Airco" service between London and Paris, which was the first daily service to start in August, 1919, has definitely closed down.

The reasons assigned for this are: The falling off in winter traffic, the difficulties of the present financial situation, and the deferring of the long-promised government support of civil aviation.

The cross-channel route is still operated by Handley Page Transport, Instone Air Line and Air Post of Banks, though the traffic recently has not warranted such regular service.

Signs of the Times in Britain

"I hope in the Estimates of next year to make some provision to encourage civil aviation. I shall make a very great effort to do so. I think it is essential to the future of the Air Service that some special effort should be made next year to help civil aviation." (*Mr. Churchill in the House of Commons,* 14 *Dec.,* 1920.)

"The present position of civil aviation causes real anxiety to the Government, and I hope to be in the position in announcing the new estimates next year to give assistance to civil aviation in new forms which will, I trust, sustain it through the difficult years." (*Mr. Churchill in the House of Commons, 20 Dec.,* 1920.)

French Air Plans

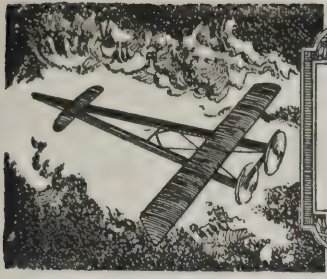
While last year the estimates under aviation were approximately $11,500,000, M. Flandin is asking for 1921 over $16,000,000. It is M. Flandin's ambition, the *Times* states, to see France in three years' time at the head of the whole world in aerial transportation—developing lines all over the country and linking up with other nations in fast freight and passenger services. Big grants are to be made to private enterprise in the coming year. Thus subsidies will be given to existing lines between Paris and London, Brussels, Toulouse, and Monaco, with extensions to Amsterdam, Strasbourg, and Warsaw. Large hangars are to be constructed at Marseilles, Algiers, Casablanca, and Tunis, so that a service of lighter than air dirigibles between France and North Africa may be put into regular operation. Regular seaplane services between Antibes, Marseilles, Perpignan, and Tunis, Algiers, Oran, and Agadir are to be established. It is also proposed to spend a considerable amount of money in developing Constantinople as an air port.

New German Air Service

The Handley Page Berlin Correspondent reports the establishment of a regular daily air service between Stuttgart and the town of Constance on Lake Constance in the Grand Duchy of Baden. Aeroplanes leave Stuttgart-Wasen at 11.15 a. m., arriving at Constance at 12.30 p. m. The new service is expected to facilitate communications with Switzerland which have been prejudiced to a certain extent by the refusal of the Inter-allied Commission to allow flying over French territory or operations within certain zones

Melbourne-Perth Flight

The first flight from Melbourne to Perth was completed on Sunday, December 12. The flying time was 18 hours 12 minutes, and the average speed per hour 120 miles over 2,000 odd miles.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

A Flying Model of the Fokker Biplane

As the German Fokker biplane has received considerable attention from aircraft builders throughout the world, it is certainly worthy of some study on the part of amateur experimenters in the United States. The Fokker appears to have been dissected and analyzed from every standpoint by the United States Government engineers, and many good points have been discovered in its design and construction. The original German plane was equipped with a 180 h.p. Mercedes engine, but various American engines, such as the Packard and Liberty 8, have been substituted in this country with surprisingly successful results.

In the full-sized Fokker the entire fuselage, chassis and interplane struts are of steel tube. The wings, on the contrary, are built of wood, with very few metal parts. The wing bracing is of cantilever principle: wires are entirely absent in the structure (except for the chassis cables). The wing structure is made rigid enough to carry the loads imposed upon it by the fact that a deep tapered wing section is employed. At the center the wings are deep and each successive rib is lessened in depth as it nears the wing tip. Another feature that results in rigidity is the fact that both upper and lower wings are continuous throughout their spans, and not hinged or pin-jointed at the body, as most wings are.

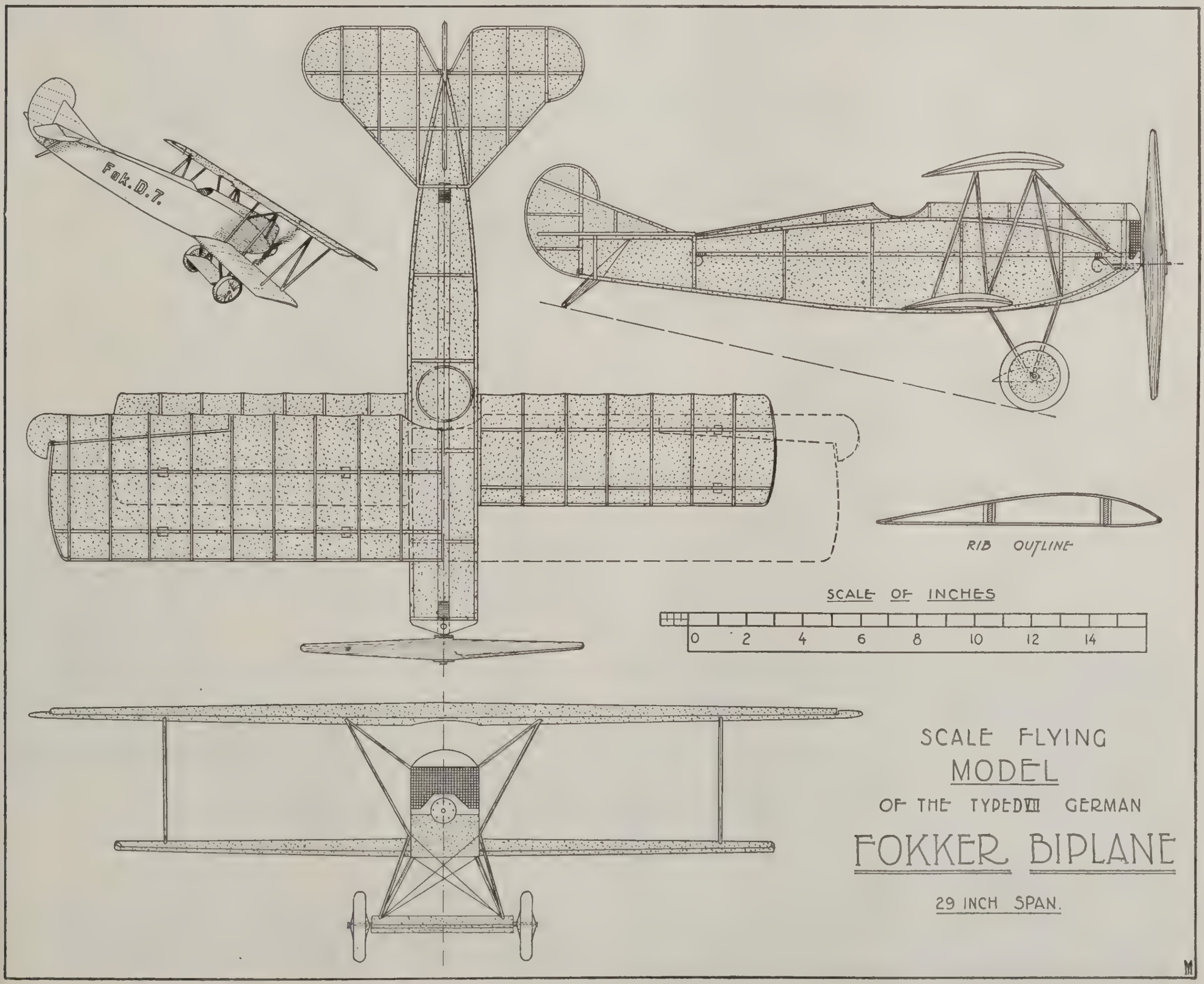
For the purpose of designing a model that will fly well, it is desirable to form our structure in many ways differing internally from the full-sized machine, but sufficient external likeness has been preserved to make a pleasing replica of the original. Model builders must remember that many sacrifices must be made in the details in order to obtain sufficient lightness to permit flight; for example, the control surfaces are designed as parts of the fixed surfaces, as movable surfaces in a model are unnecessary and sometimes a disadvantage. The same idea applies to the rib spacing, which is three or four times greater than if true proportions were adhered to.

The following list of dimensions will give the builder the general proportions of the Fokker model:

	Inches
Upper wing span, with ailerons	29
Lower wing span	23
Chord of upper wing	5⅛
Chord of lower wing	3⅞
Gap between wings	4⅝
Chassis wing span	5
Chassis wing chord	2⅛
Overall length	22¼
Height (with propeller horizontal)	9
Propeller diameter	10

Details of structure will be discussed in a subsequent article in these columns. If possible, the builder should redraw the general outline (given below) at actual size, as this will greatly facilitate construction.

(To be continued)



Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Aeronaut

It is the daring aeronaut
Who sails the azure sky.
"Is it hard to be an aeronaut,
And learn these planes to fly?"
"'Ell, no," replies the aeronaut,
"'Tis soft to learn to fly.
These planes will sail and sail and sail,
And never falter once;
They'll loop the loop, cut figure eights,
And do all kinds of stunts.
But aviation is for men, and not for sickly runts.
So keep your nerve, and use your grit,
If you would do these stunts."
"Oh, I have grit, and I have nerve, and I would like to be
An aeronaut like you!" they cry, who come these planes to see;
Who push, and crowd, and crane their necks
These wondrous planes to see.
The aviator takes his place,
The engine gives a roar,
And up into the azure sky the yokels see him soar.
He does a tail-spin in the air
Which thrills them to the core.
How fine to be an aeronaut,
And spurn this paltry ground.
To like an eagle take the air
And circle round and round.

Alas, I fear 'tis not for me
A daring aeronaut to be.

—*Edward L. Corey.*

"Why does an aviator wear colored goggles?"
"So he can see the air currents."

—*Sid. Seeznt.*

Another Record

A hopeful air pilot of Pinner
Got gradually thinner and thinner,
Till at last (it was rummy)
There was not enough "tummy"
To effectually streamline his dinner,
So he soared in a flight
To a heavenly height . . . .
He now twangs on the harp—a beginner.

Aerial Slang in Poetry

As you take off thru life's dominion.
Do it with a smile,
For you may skid back to the yesterday
In a tail-spin of a mile.

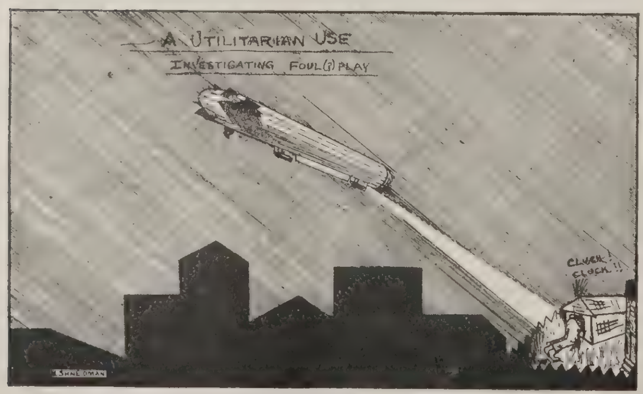
Zoom o'er all the rough spots,
But bank away your cash,
Pull back on your stick in landing
For the fear of an awful crash.

Fly thru life on the level,
You'll gain altitude by this;
You will find that in stunting
Everything will be in bliss.

Never know more than your instructor,
There would be no need of him if you did,
So always do as he says,
No matter what he bids.

When you are old and feeble,
And you seem a little sick,
Just think of those dear old yesterdays,
And the days you held the OLD Stick.

—*J. A. A.*



The Sky Pilot

West winds, cease from your heavy blow;
Back to the mountains, back again go.
My ship is idle, the pilot too—
O winds of the west, we wait for you.
Go, Go.

Blow softly this favor we pray you bestow;
But never a kindness to us you show.
You toss the sailboats upon the sea,
But scorn to notice what harm to me.
Blow, Blow.

Now over the landscape below we race
While winds are driven across my face.
We sail toward clouds of deepest blue;
O winds of the west, we're coming to you.
Blue, Blue.

Be strong, my rudder; be staunch, my plane;
Be swift, my motor; and not in vain,
Oh, bear us across the billowy sky,
And bring us back safely, the ship and I.
Bye, Bye.

The pines on the hillside are waving their tops,
And below in the meadow is shaken the copse;
But I hark to the music my motor sings,
As we speed on our way on light, airy wings.
Sings, Sings.

The soft feath'ry creatures winging their flight
Fly away rudely startled toward haunts of the night.
The clouds are tingeing in red and gold;
The sun is sinking, the air grows cold.
Swings, Swings.

But up in the sky bright shafts of day
Flash on my wings and light up my way;
While far, far beneath us, afar from the west,
Long shadows are lulling the earth to rest.
Rest, Rest.

Just over the mountains below is our home.
We gracefully glide from the height we have clomb;
We skim o'er the earth before we alight,
Then settle back gently—we've ended our flight.

—*F. Milton Weeks.*

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Why Kill the Bird That Laid the Golden Egg?

The Air Mail Endangered

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iptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

NOW READY

Textbook *of* Aero Engines

By

E. H. SHERBONDY

Consulting Engineer

Consulting Engineer to Airplane Engineering Department, U. S. War Department,
Consulting Engineer to Naval Consulting Board

and

G. DOUGLAS WARDROP

Editor of "Aerial Age Weekly"

Member Aerial League of America, Society of Automotive Engineers, American
Society of Mechanical Engineers, American Society of
Naval Engineers, Franklin Institute, etc.

DEVELOPMENTS of tremendous importance in aero engines occurred during the war period, and realizing that there was not available an authoritative work of a thoroughly up-to-date character on aero engines, The Frederick A. Stokes Company arranged with E. H. Sherbondy and G. Douglas Wardrop to prepare a comprehensive volume, dealing with the principles and theory of aero engines, and describing completely all of the successful aero engines that have been developed during the war.

This volume will comprise 400 pages of large size, seven inches by ten, presenting a very full discussion of every important phase of the subject and also the presentation of photographs and diagrams of a size to be of value to the designing engineer and student.

The work has been prepared for the purpose of having in one volume the complete information concerning all modern types of aero engines and an up-to-the-minute discussion of the principles of aero engine design and construction, so that the reader may be able to undertake comparative research without recourse to a formidable list of volumes and publications, which in any event could only supply him with more or less obsolete information.

TO THE FREDERICK A. STOKES COMPANY,
443 Fourth Avenue, New York.

Please send me a copy of the Textbook of Aero Engines, by Sherbondy and Wardrop, for which I enclose my check for ten dollars herewith.

(Signed) . . . .

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THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY

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THE AIR MAIL ENDANGERED

THE elimination of the $1,200,000 provision for the air mail from the post office appropriation is a recent achievement of the House of Representatives at Washington. After establishing a service covering 3,460 miles, Congress contemplates its entire discontinuance.

This is especially astonishing when the governmental attitude toward armament is taken into consideration. It is probable that we shall return to our former small army policy. Our navy does not promise to be as large as Mr. Daniels would like to have it. Aviation will feel directly the result of this curtailment, and it would seem that nothing could be better calculated to put the aeronautical industry into a sort of coma than this death warrant served upon the chief civil aerial activity under the Government. The post office has developed practical flying to a remarkable degree, establishing steady service, improving existing motors and aeroplanes, and encouraging new machines, better aeroplane equipment, and adequate landing facilities. The air mail functions slowly still at its stations, but cuts time in half between them. If it represents a loss, the loss is small. It is the symbol of what can be done for flying by the Government through promoting civil as apart from military activity. If we do not wish to be fighters, and still would like to retain a grip on aviation, we cannot abolish the air mail. Yet Congress has already begun scrapping armaments and the House has killed the aerial mail provision. Unless the Senate restores it the outlook for American flying will be poor.—*Editorial in N. Y. Globe.*

No Air Law

ALMOST two years have passed since the world's aeronautical experts devised the first international code of laws to govern aerial navigation. The code is embodied in an aerial convention which has been ratified by every leading country of the world with the exception of the United States. True, it has been signed by the American Ambassador in Paris, but with reservations, the Administration having overcome its aversion to this horrid word. But the Senate has not yet even considered the treaty. The result is there is not in this country any law to govern the actions of aviations except the recently passed ordinances of New York and Newark.

The landing of the three Naval balloonists in the wilderness of northern Canada has again brought this important fact forcibly before the public. Canada, having ratified the convention, consequently had the machinery at hand necessary to meet the technical situation that followed when erpresentatives of the armed forces of a foreign power landed within proscribed regions of her territory. Fortunately, the feeling of the surprised host was friendly.

The laws that must govern aerial navigation are of necessity based upon admiralty laws. They must perforce cover movements of traffic in three dimensions. Moreover, they must meet new customs situations, with attendant smuggling possibilities.

But it is not merely to regulate flying in any form that aerial laws are most needed. The present situation in this country is highly prejudicial to the natural development of our aeronautical industry, a key industry in national defense. Until such laws are enacted by Congress none of the proposed commercial ventures in the air can well be undertaken.

Congress obviously should act in this matter as quickly as possible, making its regulations conform to the international code as much as possible.—*Editorial in N. Y. Tribune.*

The Necessity of Wood Conservation

FEW persons who have not given the matter some study appreciate the extent and importance of the wood-using industries or the necessity of conservation in the raw and finished material upon which they are dependent. The value of the products of the primary and secondary wood-using industries is said to aggregate over ten billion dollars annually, and these industries employ more than any other single industry in this country. Under these circumstances it is of course a necessity that conservation of forest products be practiced and encouraged by every possible means. A great work in this direction has been done by the Forest Products Laboratory which is a branch of the Forest Service of the U. S. Department of Agriculture. It is conservatively estimated that the commercial application of research work carried on by the laboratory is already saving the country $30,000,000 annually.

The aeronautic industry is a large user of wood and has profited in no small measure as a result of the work of the laboratory. It could profit to a much greater extent if the value of the work done was more widely appreciated. Information concerning economy and more effective use of lumber (with consequent safety in shipments, economical operation of kilns, preservation and finishing of wood, and much other information of great value along similar lines has resulted from the activities of the laboratory and is being distributed by it to the great good of all users of wood and articles in the construction or packing of which wood or its products are employed.

The Forest Products Laboratory is largely dependent upon Congressional appropriations for its support, and is seeking an appropriation of $400,000 for the coming year. It should have at least this amount and members of Congress should be made to appreciate the value of the work done and the need of further research, both from the standpoint of the industries directly benefited and the public which is certain to benefit in a still larger degree. We urge that our readers look into the matter for their own good and then see that their Congressional representatives are duly informed of their views. Particulars can be had from the laboratory itself as well as from the Association of Wood Using Industries, Monadnock Bldg., Chicago.

THE NEWS OF THE WEEK

Eight Entries for the First Aerial Derby Around the World

Major Charles J. Glidden, Executive Secretary of the Commission which organized the First Aerial Derby Around the World, and who is maintaining an interest in the event pending the formation of rules by the Federation Aeronautique International, and the conducting of the Derby by the Aero Club of America and the Aerial League of America, announces the following entries to date:

1. International Navigation Co., St. Louis, by C. J. Conterman.
2. Unberto Goio, Panama.
3. W. Maun, Bombay, India.
4. Etienne Poulet, Paris, France.
5. Harry Burton Lewis, Hon. Lieut. Royal Air Service, London.
6. Western Airplane Syndicate, Cincinnati, O., by M. H. Hill.
7. H. W. Hoyt, Lt. Royal Air Force, Howden, England.
8. G. Raymond Richman, Camden, N. J.

Sixty-six commissioners have been appointed in 49 countries and colonies to assist in conducting the Derby.

Navy Asks for Air Station Site as Gift

The Sinking Fund Commission was asked yesterday by Rear Admiral John H. Glennon, Commander of the Third Naval District, to deed to the navy the land at Rockaway Beach now being used as a naval air station. The land consists of 194 acres and is part of the Jacob Riis Park. It was bought by New York city during the Mitchel Administration for $1,400,000.

Dock Commissioner Hulbert, while not opposing the plan to turn the land over to the navy, thought the Federal Government should pay something for it. He admitted that the Navy Department had been the only Federal department that had done anything for the city in return for what the city had done during the war. He cited the fact that Secretary of War Baker had just decided against the city in the matter of pier extensions on the Hudson River and had ordered the extensions to be removed by May 1.

Admiral Glennon said that the purpose of the station was to protect the City of New York. He said he did not believe the Navy, under any circumstances, would consider buying the land. He said that the improvements already made represented an investment of about $2,000,000 and that it would probably be necessary to spend $1,000,000 more to build a sea wall to protect the air station permanently. The station, he said, would be a distinct asset to the city. President La Guardia of the Board of Aldermen suggested that the location of the air station at Rockaway would do much to develop the aviation industry in the United States.

Lockport, La., Bids for Place on Aerial Map

Through the efforts of F. C. Barrios of the Barrios Motor Company of Lockport, La., and the co-operation of the Lockport Association of Commerce it seems that Lockport, La., is soon to be on the aerial map of the country. An aviation field has been secured near the Lockport Central Sugar Factory about a mile east of Lockport. The field is to be approximately one thousand by twelve hundred feet, and will no doubt be one of the finest aviation fields in this section of country for some time to come. The citizens of Lockport are enthusiastic on the subject of aviation, and an aviation field, and will hail with delight the success that has attended the efforts of the promoters of a local field.

A description of the field with full data and other particulars will be furnished at once to the Hydrographic Office of the United States Navy Department for acceptance.

U. S. May Get German Air Equipment

Representatives of the Army and Navy will shortly confer with the Interallied Aeronautical Commission which is in charge of the distribution of air equipment turned over by Germany to the Allied governments. The U. S. Navy representative is Lieut. Frederic P. Culbert, U. S. N., now in Europe on duty in connection with the Navy dirigible R-38. Recommendation has been made to the War Department for the appointment as the Army representatives of Major Benjamin D. Foulois, U. S. A., now on duty in the office of the military attaché at The Hague, and Major Frank M. Kennedy, U. S. A. Action on the distribution, it is understood, will not be taken until late this month.

Aero Club of La Crosse Active

The Aero Club of La Crosse, La Crosse, Wisconsin, is one of the most active aeronautic organizations in the middle west.

Airscape of Hell Gate Bridge, New York City

Photo by U. S. Army Air Service

Through the activities of the members an excellent flying field has been procured and is now being used daily by the aerial mail pilots on the route between Chicago and the Twin Cities.

John P. Salzer is President of the Club; A. A. Bentley, Vice-President; H. K. Holley, Treasurer; James R. Kinsloe, Secretary, and the Directors are F. H. Burgess, C. H. Collins, William Helfach, F. P. Hixon, W. F. Hurtgen and Lloyd Lamb.

M. I. T. Courses

Courses of instruction in aeronautics have been resumed at the Massachusetts Institute of Technology. The course is taken by 19 students including a detail of 8 Army officers. The wind tunnel is now available to private testing, although it is understood that Army testing is still carried on.

Airships Planned for Mackenzie Oil Rush

Edmonton, Jan. 20.—A huge dirigible airship carrying thirty-two passengers and five tons of freight will ply the air line between Edmonton and Fort Norman in March, while a flying boat service will also be maintained to the Arctic by an eastern Canadian firm.

Major Jenner, of Vancouver, British Columbia, and Major Woolan, of Los Angeles, are expected to arrive in Edmonton in the course of a few days to select aerodrome sites for their dirigible airships, and with the arrival of their ship from the States early in the spring, will operate a passenger service between this point and the site of the drilling operations at Fort Norman and Great Slave Lake, a thousand miles north. F. G. Erickson, the head of a large Toronto aircraft firm, also announces that he will operate a flying boat service to all points in the Mackenzie River basin, commencing operations in May.

Flying in the far north is understood to be possible for from six to eight months in the year, but that this figure may be exceeded is probable, as the two new all-metal 'planes for the Imperial Oil Company flew from New York to Edmonton at the season of the year which in the north is one of extreme cold, but the journey was made without undue hardship to the aviators.

In addition to the firms mentioned who are putting on air services to the north a number of local concerns are tuning up their planes for the long flight to the Arctic, and as soon as the ice goes out of the rivers, allowing the flying boats to find landing water, a string of air craft will be winging their way to the new El Dorado.

Northwestern Canada possesses a tremendous system of waterways, while lakes abound by the thousand, hence the aviators feel that a journey over the unmapped wilderness will not be even as dangerous as flying over land with wheeled machines. A multitude of landing places are available on the different bodies of water, and before many months are past the drone of the whirling propellers will be heard by the astonished natives and the traders of the Great Lone Land, who hitherto have seen nothing more modern in the way of transport than the little river steamer paying her annual call for furs.

Ornithopter Being Tried

An aeroplane with wings that flap like a bird has been patented by Thomas J. Bird, formerly of Johnson City, Tenn., now a resident of Hampton, Va. The machine is reported to have been tested and has proven its ability to fly. The motive power is supplied by a small gasoline engine of low horsepower. The principal mechanism is the universal joint bearing boxes which connect the wings of the machine to the body, wherewith the wings are caused to swing, flapping like those of a bird in the air; and the wing gliding disc that causes the wings to move downward and upward in an oblong-circular movement, similar to that of an oarsman rowing a boat.

The wing construction is also reported to consist of overlapping slats which automatically close on the downward and forward thrust, and open as the wings rise again. The inventor claims that it is possible to attain a speed approaching ninety miles per hour.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, November, 1920

													SERVICE AND UNIT COST					
DIVISION	Gas.	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Pilots	Mechanics and Helpers	Departmental Overhead Charge	Interest on Investment	TOTAL	Gallons of Gas.	Total Time Run	Total Miles Run	Miles Run per Gallon of Gas.	Cost per Hour	Cost per Mile
New York-Washington..	$2,083.58	$311.61	$922.95	$967.09	$1,102.66	$620.35	$898.12	$996.78	$2,405.15	$377.38	$543.75	$11,229.42	5,550	hr. min. 192 48	15,725	2.8	$58.24	$0.71
St. Louis-Twin Cities..	1,576.71	403.12	1,059.78	1,844.29	597.76	333.91	1,140.32	2,977.57	2,939.22	1,132.14	944.94	14,949.76	4,390	185 12	13,157	3.0	80.72	1.14
New York-Cleveland....	2,599.58	485.63	2,287.11	2,491.57	936.02	545.68	1,638.15	2,721.93	3,698.54	754.76	1,417.92	19,576.89	7,415	235 26	18,801	2.5	83.15	1.04
Cleveland-Chicago.....	1,982.29	478.38	3,636.76	1,306.76	591.01	191.76	1,237.15	1,809.91	1,949.26	566.07	750.00	14,499.35	6,823	163 01	14,559	2.1	88.94	1.00
Chicago-Omaha......	1,876.71	426.22	1,965.05	1,622.04	465.81	268.07	908.57	1,858.65	2,672.13	754.76	984.17	13,802.18	5,390	206 07	18,545	3.4	66.96	.74
Omaha-Salt Lake....	5,057.91	1,266.96	4,909.88	3,582.20	664.72	426.65	1,297.64	3,812.09	3,183.68	1,572.42	645.84	26,419.99	14,029	413 24	36,478	2.6	63.91	.72
Salt Lake-San Francisco	2,459.19	548.32	3,844.97	4,697.37	839.59	124.75	1,961.06	2,283.08	2,662.26	1,132.16	470.84	21,023.59	6,976	255 22	22,494	3.2	82.33	.93
Totals and Averages.....	$17,635.97	$3,920.24	$18,626.50	$16,511.32	$5,197.57	$2,511.17	$9,081.01	$16,460.01	$19,510.24	$6,289.69	$5,757.46	$121,501.18	50,573	1,651 20	139,759	2.8	$73.57	$0.87

Planes operated on New York-Washington Division:
- Curtiss R4's, equipped with Liberty 12 motors.
- Curtiss JN4D, equipped with Curtiss OX5 motor.
- De Havilands, equipped with Liberty 12 motors.

Planes operated on St. Louis-Twin Cities Division:
- Standard, equipped with Hispano-Suiza motor.
- Curtiss JN4H's, equipped with Hispano-Suiza motors.
- Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on New York-Cleveland Division:
- Curtiss R4's, equipped with Liberty 12 motors.
- De Havilands, equipped with Liberty 12 motors.
- Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on Cleveland-Chicago Division:
- De Havilands, equipped with Liberty 12 motors.
- Twin De Havilands, equipped with two Liberty 6 motors.
- Martins, equipped with two Liberty 12 motors.

Planes operated on Chicago-Omaha Division:
- Standard, equipped with Hispano-Suiza motor.
- De Havilands, equipped with Liberty 12 motors.
- Twin De Haviland, equipped with two Liberty 6 motors.
- Junkers (J. L. Larsen), equipped with B. M. W. motors.

Planes operated on Omaha-Salt Lake Division:
- De Havilands, equipped with Liberty 12 motors.

Planes operated on Salt Lake-San Francisco Division:
- De Havilands, equipped with Liberty 12 motors.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington..........	$0.22	$0.22	$0.27
St. Louis-Twin Cities............	.32	.38	.44
New York-Cleveland............	.28	.31	.45
Cleveland-Chicago..............	.23	.29	.48
Chicago-Omaha................	.18	.22	.34
Omaha-Salt Lake...............	.12	.28	.32
Salt Lake-San Francisco.........	.20	.23	.50
Entire Service..................	$0.21	$0.27	$0.39

OTTO PRAEGER, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

S. A. E. Report on Commercial Air Navigation

Owing to the importance of outlining a definite program which would be of value in protecting commercial aviation against adverse legislation, the council of the Society of Automotive Engineers charged the aeronautic division some time ago with the preparation of a special report outlining desirable regulations for commercial air navigation. The subject was referred to the aeronautic subdivision on performance and testing and a meeting was held at which the following recommendations were adopted:

A system of federal registration of all aircraft for identification and in addition, licenses for certain specific purposes or uses should be adopted.

All aircraft carrying passengers for any purpose, or goods in commercial service, should be licensed by the federal authority, which license shall indicate the aircraft licensed has complied with certain minimum requirements as to safety. By passengers is meant any person not a necessary member of the crew.

Any aircraft not coming under the classification in the previous paragraph may be licensed by the federal authority even though not complying with the safety requirements, but only for restricted service with a view to minimizing danger to persons or property on the ground. This is intended to cover experimental and special racing aircraft as well as privately owned aircraft not used in commercial or government service. Minimum requirements cannot, even as regards the structural strength, be reduced to rules and figures capable of application in inspection except by persons of adequate engineering training in this field, and other necessary minimum requirements regarding safety of operation are the result of compromise and can only be applied by persons with trained judgment.

Any definite requirements or figures should not be written into legislation at this time, because these matters would be handled best by the regulation and ruling of the federal authorities which should be created by legislation.

Aircraft, which, in accordance with previous paragraphs, require a license, should be periodically inspected to insure that they continue to be in a safe operating condition.

Aerological Service in Rockies

A branch of the Helena, Mont., office United States Weather Bureau, will be established at Blossburg, on the summit of the Continental divide, for observations of air currents and other details which will be used in charting a safe route for aeroplanes above and across the Rockies.

Aeroplane Engines Are to Be Sold

Between 1,500 and 1,600 aeroplane engines of foreign construction, ranging from 90 to 400-horsepower, acquired by the war department since April 6, 1917, have been declared surplus and soon will be advertised for sale by the surplus property division, office of the quartermaster general. The disposal of this class of material has heretofore been confined by the war department to the United States, but this lot, together with 2,448 American-made engines of forty-five and ninety horsepower, will be advertised in South America, France and England as well as in the United States. The foreign models are of French, English and Italian design, and the United States models are the Hall Scott and the Lawrence. In addition to the engines to be sold there are some old aeroplanes of French and German design, including the German Albatross, the Halberstadt and Rumpler, and the French Breguet and Nieuports.

Oberlin Aircraft Company Organized

The Oberlin Aircraft Company of Oberlin, Ohio, has been organized to conduct a training school and engage in aerial photography and aerial advertising. T. J. Rice is manager of the company and B. C. Worcester is Secretary and Treasurer. The pilots are C. H. Hadlich and F. D. Henderson.

American Aerial Advertising Company Organized

The American Aerial Advertising Company has been organized in Auburn, Ind., and will engage in advertising, photographic and passenger transportation work commencing this Spring.

John S. Ashley is President; B. F. Harrell, Vice-President, and Mrs. Ruth L. Ashley, Secretary and Treasurer.

Lawson Air Mail Service to Begin May 15th

Alfred W. Lawson, President of the Lawson Airplane Company of Milwaukee, has been notified by the Post Office Department at Washington that an extension of time has been granted for the beginning of the air mail service until May 15th.

Mr. Lawson asked to begin the air mail service in May instead of in January as previously considered, for the reason that it will afford six warm months to get the service properly established before the cold winter months of next year come on.

The three different routes contracted for are as follows:

Route No. 1—New York, Harrisburg, Pittsburgh, Fort Wayne, and Chicago.

Route No. 2—Pittsburgh, Columbus, Cincinnati, Indianapolis, and St. Louis.

Route No. 3—New York, Washington, Raleigh, Columbia, and Atlanta.

Besides carrying the United States mail over these routes the company will also carry passengers and express so that a daily service will be established for the convenience of the public who wish to reach their destinations quickly.

Mr. Lawson has been working on the plans of this air service for some time past, and he says that his plans are now in such shape that there will be no difficulty in beginning the service by the middle of May.

He has been assured landing fields in all of the cities on the three routes and has already ordered the equipment necessary for operation. His personnel consists of more than 300 of the leading aircraft specialists of this country, as well as a large number of experienced transportation men and others who understand the handling of Uncle Sam's mail.

Ten large airliners have been ordered from the Lawson Airplane Company of Milwaukee to be delivered before May 15th, and two of them are now all completed and ready for delivery. The other eight will be turned out as quickly as the plant facilities will warrant. Twenty small auxiliary aeroplanes have also been ordered from other concerns and delivery promised by May 1st.

German Daimler 600 h. p. Engine

Technical information of the German "Daimler" 600 h.p. motor is given, as follows: Bore, 235 mm.; stroke, 250 mm. The horsepower is 650 at 1,250 revolutions. The petrol consumption is 230 grammes, and of oil, 15 grammes per h.p. The engine develops 400 to 450 b.h.p. at 900 revs. per minute, and 250 h.p. at 500 revs. The weight of the engine is about 1,050 kilogrammes. (*La Conquête de l'Air,* Aug. 1, 1920. ½ col.)

Book Review

Mr. Hiram Bingham, formerly Lieutenant-Colonel in the Air Service, has published through the Yale University Press a book which he has called "An Explorer in the Air Service." Mr. Bingham has written an interesting, informal, but comprehensive and accurate view of the training for aviators in the war.

The author's service record was such as to give him an exceptional opportunity to present a cross-section of army aviation. He began to fly at Miami in March, 1917; was on duty at Aviation Headquarters in Washington from the first of May, 1917, until the first of April, 1918; was then on duty with the Chief of Air Service in the A. E. F. until the latter part of August, 1918, at which time he assumed command of the instruction center at Issoudun; returning to Washington after Christmas he was again on duty at headquarters until March, 1919.

According to the Preface: "This book is an unofficial, personal record of those two years. It deals largely with the problems of aviation training. It is hoped that it will be of interest to those who were in the Air Service and their friends, besides being of some assistance to future students of military aeronautics. To many of the pilots it may explain the reasons for some of the sufferings which they endured. It may serve also as a warning of the evil of unpreparedness. Nearly all of the errors, mistakes, and delays to which it refers might have been avoided, had the American people insisted on having their representatives in Congress make suitable preparation for an adequate army and a well-equipped Air Service in the event of our being thrown into the World War. "An Explorer in the Air Service" is fully illustrated.

STRENGTH TESTS OF SCREW FASTENINGS OF PLYWOOD

By H. S. GRENOBLE*

PLYWOOD in many of its uses requires nails or screws to fasten it to a frame. The selection of the proper size of nail or screw, the spacing, and margin calls for knowledge relative to the purpose for which the plywood is to be used. If the plywood is to be used as a mere covering the size of nail or screw used or the spacing are relatively unimportant. But if the plywood must add stiffness and the stresses to be carried approach the full strength of the plywood, the size of nail or screw, spacing, and margin become important factors. The absence of accurate data on this subject led the Forest Products Laboratory, Madison, Wisconsin, to make an extensive series of tests on the strength of screw fastenings in 3-ply wood. These tests included the following factors: Size and kind of screw; use of washers; margin—edge of hole to edge of plywood; spacing—center to center of screws; species of plywood and of the member to which the fastening was made.

Species Grouped According to Fastening Strength

The species investigated were divided into three groups in accordance with the strength of fastenings which they developed. The same size of screw, margin, and spacing are recommended for a given total plywood thickness for all species of any one group. Differences in strength between species of the same group were not sufficient to affect the variables appreciably.

Group I—Low density species principally conifers and such broad-leaved (more commonly called hardwood) trees as basswood, cottonwood, and yellow poplar. The recommendations are, however, applicable to other species of approximately the same density.

Group II—Medium density species. These are all broad-leaved trees. Red gum is considered the best representative of this group.

Group III—High density species. These are all broad-leaved trees and consist of those species which developed the highest fastening strength. Hard maple is a good representative of this group.

Explanation of Table

Table 1 presents in a condensed and easily accessible form the most important and most practical results of the study. In it are given the screw sizes, margins, and spacing for use with various species and plywood thicknesses. The gauge is the smallest gauge of screw that can be used with the thickness specified and not cause failure due to breaking of the screw when the full strength value of the plywood is developed. The length of screw is the shortest which will prevent failure in the fastening due to pulling out of the screw. The margin is the smallest margin which will insure against failure by shear. The spacing is that spacing which gave maximum strength per linear inch. Fastenings made with round-head screws without washers were found to be inferior in strength to flat-head screws without washers. Of the three combinations tested, flat-head screws without washers or round-head with washers gave the best results.

Point Where Strength Does Not Increase with Screw Length

Up to a certain point the strength of the fastening was found to increase as the length of the screw increased, but an optimum length was soon reached. Tests with screws of greater length gave no increase in strength of fastening for the corresponding increase in length of screw. The optimum length was found to vary with the density of the block into which the screw was driven. Low-density woods when used as members for receiving the screw points were found to require longer screws than high-density woods. Little difference was found in this respect in the optimum length of flat-head screws without washers and round-head screws with washers.

Margins Shown Are Minimum

Tests relative to margins showed that if smaller margins than those specified are used plywood failure due to shear may occur, and that greater margins do not increase the strength of the screw fastening since failure due to crushing usually occurs in the plywood.

Strength Varies with Spacing

Strength of fastenings per inch of width was found to increase with decrease of spacing until a minimum was reached. Spacings less than the minimum often caused failures in the plywood due to tension or splitting in the member to which the plywood was fastened. The data given in table 1 are based on spacing in a single row, but staggering is recommended whenever possible.

Strength Varies with Density

The strength of screw fastenings was found to increase with the density of the plywood. This relation for any one total plywood thickness may be shown in the form of an exponential curve. This relation conforms with the strength-density laws derived from previous experiments which showed that the best criterion in selecting material possessing high strength properties is to select the heaviest pieces.

Rule for Gauge of Screw

The strength of screw fastenings was also found to vary approximately with the thickness of the plywood. An empirical rule for determining the gauge of screw for 3-ply wood of species found in Group II of thickness different from those given in the table is:

Gauge of screw to be used = 2½ + thickness of plywood expressed in twenty-fifths of an inch.

TABLE 1

PLYWOOD SCREW FASTENING SCHEDULE FOR MAXIMUM STRENGTH†

Spacing, margin, gauge (number) and length of screw to use for fastening plywood to wooden members.

Species of plywood	Thickness of plywood in inches	Gauge (number) of screw	Length of screw in inches Species receiving point Ash	Spruce	Margin in inches	Spacing in inches
1	2	3	4	5	6	7
Group I	3/30	4	½	⅝	½	⅜
	3/24	5	½	⅝	⅝	½
	3/20	6	⅝	¾	⅝	½
	3/16	7	⅝	¾	⅝	⅝
	3/10	9	¾	1	¾	¾
	3/8	11	1	1¼	¾	¾
Group II	3/30	5	½	⅝	½	½
	3/24	6	⅝	¾	⅝	½
	3/20	7	¾	⅞	⅝	⅝
	3/16	8	⅞	1	⅝	¾
	3/10	10	1	1¼	¾	¾
	3/8	12	1¼	1½	¾	⅞
Group III	3/30	6	⅝	¾	½	½
	3/24	7	¾	1	⅝	⅝
	3/20	8	1	1¼	⅝	¾
	3/16	9	1¼	1½	⅝	¾
	3/10	11	1½	1¾	¾	⅞
	3/8	13	1¾	2	¾	1

Group I	Group II	Group III
Basswood	Ash, black	Ash, white
Cedar, Spanish	Ash, pumpkin	Beech
Cottonwood	Elm, white	Birch
Cypress, bald	Gum, black	Cherry, black
Douglas fir	Gum, cotton	Elm, cork
Fir, true	Gum, red	Maple, hard
Hemlock	Hackberry	
Pine, sugar	Magnolia	
Pine, white	Mahogany, true and African	
Poplar, yellow	Maple, soft	
Redwood	Sycamore	
Spruce, Sitka	Tanguile	
	Walnut, black	

† This table is based on spacing in a single row but staggering is recommended whenever possible. Consideration must be given the fact that the size and number of screws required for maximum strength may materially weaken the member receiving the screw points.

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* Engineer in Forest Products, U. S. Forest Service, Forest Products Laboratory, Madison, Wisconsin.

Fractional value should be considered as the next larger whole number.

For species found in Group I use one gauge smaller.

For species found in Group III use one gauge larger.

Danger of Splitting in Providing for Maximum Strength

Attention should be called to the fact that the size and number of screws required for maximum strength may materially weaken the member receiving the screw points. The data given are intended primarily as a guide in selecting the proper size of screw to give a fastening equal to the strength of the plywood. The size of member into which the screw was driven was necessarily a secondary consideration. In all tests a size of block was selected which would insure against failure in the block after the load was applied. Until additional data are available designers must give due consideration to the liability of splitting the frame, through too close spacing or the use of too large a screw in attaching the plywood.

CANADIAN GOVERNMENT PURCHASES TEN AEROMARINE NAVY FLYING BOATS FOR FOREST PATROL WORK

The Aeromarine Engineering and Sales Company, Charles F. Redden, President, which recently acquired surplus aircraft and engines from the Navy Department, finds that the remarkable publicity given the recent Naval balloon flight over Canada, has greatly accelerated the promotion of commercial aeronautics in the Dominion.

Mr. Redden announces that the Canadian Government recently purchased ten Navy flying boats which are to be utilized in forest patrol and in connection with the Canadian Northwest Mounted Police.

He also announces that negotiations are pending which will result in the establishment by next July of an aerial transportation and freight line between Edmonton and Great Slave Lake and Fort Norman in the Mackenzie River Basin, in the Northwest Territories. This is the region in which there has recently been such activity in connection with the discovery of oil and the plan is to transport prospectors over the 800 or 900-mile route by air. The aerial transportation line which is to utilize the Aeromarine Navy flying boats, following the course of the Mackenzie River and nearby lakes, will carry passengers over this route in twenty-four hours, whereas by pack and canoe the time required is from six weeks to two months.

"Interest in the hardships encountered by the Naval balloonists has caused the public to overlook the fact," said Mr. Redden, "that late last summer the entire Hudson Bay region, in the vicinity of Moose Factory and Cochrane, was flown over many times with one of the Aeromarine Navy flying boats in the service of the Canadian Government. The contrast between the helplessness of a balloon, driven by the wind and beyond the control of the aeronaut, with a flying boat always under the control of the pilot, is striking.

"Early last summer the Canadian Government desired photographic charts of the country lying between Cochrane and the Hudson Bay country, and an aerial expedition was organized to make the trip.

"F. G. Ericson, then Chief Engineer of the Imperial Munitions Board of Canada, because of his experience in the designing and manufacture of aircraft, was selected as the man best fitted to determine the size and type of aircraft to be used for such an undertaking.

"Mr. Ericson had at his disposal the best aircraft of the United States and Europe, and after considering the qualifications of the various types, finally selected the Aeromarine-Navy Coast Patrol Flying Boat H.S.-2.

"The expedition, consisting of a party of five, included a representative of the Canadian Government, Irwin Proctor, a Dominion geologist, and Mr. Ericson, and carried cameras and camping equipment.

"One morning early in July the expedition, commanded by Captain Roy Maxwell of the Royal Air Force as pilot, made a short hop to Toronto, thence over the wild uncharted land and northern woods to Cochrane, the northernmost railhead.

"Establishing Cochrane as a base they made many flights to Mattice, Moose Factory, James Bay, and thence to Hudson Bay, taking aerial photographs and making aerial surveys. Eight flights were made from Cochrane to Hudson Bay in this Aeromarine-Navy Flying Boat, and so great was their confidence in its absolute reliability Mr. Ericson said, 'We never had the least concern upon leaving Cochrane as to our safe return after a flight of nearly a thousand miles over this woodland wilderness.'

"A new chapter is about to be written in the history of transportation for exploration as well as commerce. A trip from Cochrane to Moose Factory was made repeatedly in two hours, whereas the best time ordinarily made between these two points by dog teams or canoes is from three to six weeks. In discussing the advantages of these Navy boats, converted into passenger and freight carrying craft for commercial use, Mr. Ericson said, 'It will not be long before the large fur warehouses in the far north will be carrying pelts from the Hudson Bay country to railroad points by these aircraft because of the wonderful saving in time and expense. When it is possible to cover a trip in a few hours that ordinarily requires from three to six weeks, the advantage is apparent.' "

Turner Guest of World League

H. M. Turner, President of the Aero Club of Southern California, was a guest of the officers of the Aerial League of the World on January 21st.

Mr. Turner stated that great activities in aeronautics were continually going on in Southern California, especially at this season of the year; and that through the club some large cash prizes, $10,000 or better, were about to be offered for transcontinental flying, and smaller prizes for local flights.

A special prize will be offered to the Elk coming the longest distance by aeroplane to attend a convention to be held in the near future at Los Angeles.

Offers Army Flying to 500 Young Men

Washington.—Maj.-Gen. Peter C. Harris, Adjutant General of the Army, is offering a chance for 500 young men to learn how to fly an aeroplane in a new class to be started by the War Department on March 1st.

The department, he explains, is offering this opportunity to all civilians between the ages of 20 and 27 who have a high school education or its equivalent, and who desire to master all phases of military aeronautics. From the applicants 500 will be selected as flying cadets who will be sent to the Air Service School at March Field, Riverside, Cal., or to Carlstrom Field, at Arcadia, Fla., where their instruction will begin.

Their primary instruction in the theory of the art of flying at these two fields will cover a period of approximately four months. The advanced training, which consists of courses in pursuit, bombing and observation, will occupy about six months, three months of which will be spent in a service squadron. These later courses will be given at Rockwell Field, San Diego, Cal.; Ellington Field, Houston, Tex., and Post Field at Fort Sill, Okla. On completion of this course the student will be commissioned as a Second Lieutenant in the Air Service Reserve Corps and discharged.

General Harris said that young men interested in this course should make their applications direct to the Director of the Army Air Service, or they can obtain more complete information by calling on or applying to the nearest Army recruiting officer. The courses will be open only to unmarried men. The cadets will be paid $75 a month while learning and will receive a ration allowance of $1 a day, together with quarters, all clothing and equipment, medical and dental attention. Discussing the opportunity offered by this new course General Harris said:

"The importance of air transportation not only from a military but a commercial point of view is now universally established. The opportunity for young men to make a study of aeronautics does not frequently present itself in civilian life, and even in the Air Service there are only a limited number of young men who can avail themselves of the intensive course offered. To enroll in this corps of flying cadets a special physical examination is necessary, and the educational requirements are such as to assure a high type of young man."

AERONAUTIC INSTRUMENTS

By **CHARLES E. MENDENHALL, Ph.D.**
Professor of Physics, University of Wisconsin

(Concluded from last week)

Statoscope.—The purpose of this instrument is to indicate when a plane is rising, falling or flying horizontally, and it is chiefly used in performance tests. The usual form consists of a thermos bottle which can be quickly opened to or cut off from the external air by means of a stop-cock, and a scheme for indicating, or measuring, the pressure difference between the inside and outside, such as a U-tube pressure gauge containing oil. If the external pressures are equalized and the stop-cock shut at any height, then a rise or fall of the machine will be shown on the gauge as a decrease or increase of the external pressure. By this means the absolute height, so far as it is determined by constant external pressure, may be kept constant within 10 feet. A less sensitive form of instrument on this principle has been put on the market.

Rate of Climb Indicator.—If the above form of statoscope is provided with a capillary opening in place of the stop-cock, it becomes a rate of climb indicator, an absolute instrument in so far as atmospheric conditions are constant and normal. The approximate equation of the instrument is

$$\frac{d}{dt}(\triangle p) = K \triangle pP - \frac{P}{A}\frac{dH}{dt}$$

where

$\triangle p$ = pressure difference between inside and outside of flask.
P = barometric pressure at height H.
K = constant depending on size, etc,. of capillary opening.
H = altitude.
A = a constant in the assumed isothermal equation connecting altitude and pressure.

If $\triangle p$ is maintained constant then

$$\triangle p = \frac{1}{AK}\frac{dH}{dt}$$

which will be independent of altitude. That is, a constant pressure difference corresponds to a constant rate of climb. Experiments of Captain Webster's showed that readings could be made accurate to about 20 ft./min. with a capillary such that a new steady reading would be reached in about five or ten seconds after a change in elevation had occurred.

Bubble or Pendulum Inclinometer.—In a properly banked turn an aeroplane tips so that the resultant force compounded of gravity and the central acceleration, is normal to the floor of the plane, *i. e.*, bears the same relation to the plane that gravity does in straight horizontal flight. For a 60° bank, therefore, we have the relation that

$$Ac = \text{central acceleration} = \frac{S^2}{R} = g \tan 60^\circ = g\sqrt{3}$$

and $g' = \text{apparent gravity} = g \sec. 60^\circ = 2g$

Any instrument, such as a level or pendulum, which responds quickly to gravity, will therefore remain in its symmetrical or zero position during a bank and be useless as an inclinometer. Either of these devices will show a deviation, however, when a plane is not properly banked and is therefore side-slipping, and hence are of some use as indicators of *incorrect banking.* As a matter of fact a measure of the angle of bank is of no general use, though an instrument which will show when a plane is turning, and therefore usually banking, is of great use and will be discussed later. Under certain circumstances a really effective inclinometer might be of use when it is desired to fly with as even a keel as possible, and for such use a variety of gyroscopic devices have been tried. The underlying principle of these will be taken up later, but one or two may be mentioned. The simplest, though in many ways the least satisfactory, is the gyroscopic top of Garnier. This is a heavy top supported very near the center of mass on a steel pivot point, which rests in a steel or agate cup, mounted in a closed case with a spherical glass top centered at the pivot, and driven by air jets playing against the rim of the top. Strictly speaking, it is not a top, for the point of support is usually very slightly above the center of mass. Speeds of 5,000 to 10,000 r.p.m. may be obtained with an air pressure of only a few centimeters of mercury, and displacements of the top with respect to the case are read on graduations on the glass cover. It is a very pretty thing, but is too susceptible to the jars of ordinary service, and has besides several serious inherent troubles; its use has therefore not been found worth while.

Navigation of Aircraft.—The primary requisite in navigation is the ability to steer a straight course in a known direction; hence we may well introduce the subject by considering the two instruments which are designed to make this possible.

Compass.—The only practicable compass so far developed for air use is the magnetic (see Fig. 1 for standard army type), though there have been reports that a gyroscopic type will be made available.

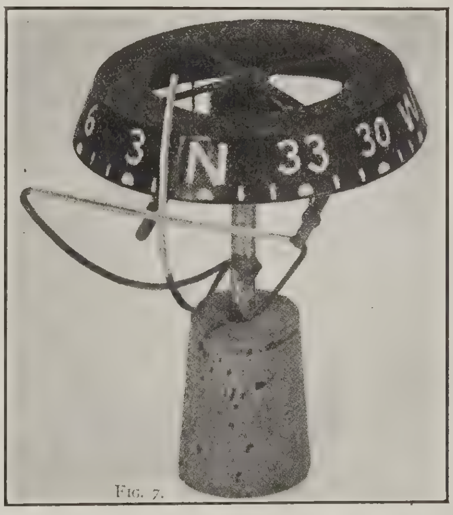


FIG. 7.

For various reasons the compass has been perhaps the most discussed and most abused instrument, chiefly because it has been expected to do two things: First, to give the direction of a maintained course; second, to indicate departures from this course. The first duty it can fairly well perform but, as we shall see, it is ill adapted to the second. A compass card of the usual type (see Fig. 7) is supported upon a pivot attached to the card, with the point slightly above the center of mass, and has the equivalent of a counterbalancing weight on the south side to overcome the couple due to the vertical component of the earth's magnetic field. In order to diminish the effect of vibration, it is necessary to reduce as much as possible the pressure of the pivot on the supporting cup, and to do this and also introduce desired damping, the cards are immersed in a liquid, either alcohol or kerosene. The forces acting upon the card are the following:

Gravitational and accelerative forces upon the symmetrical mass of the card.

Gravitational and accelerative forces upon the counter-weight.

Gravitational and accelerative components of the buoyant forces on the card.

Viscous forces between card and liquid.

Magnetic forces on the card.

The resultant motion has been most carefully analyzed by Lindeman, and while the general equations of motion cannot be integrated, his discussion of the initial motions leads to conclusions verified by experiment and indicate how to minimize certain unavoidable faults.

His first conclusion is that the card will always set its plane very nearly normal to the "apparent gravity" on a bank. This being true, simple considerations suffice to prove the existence, though not the magnitude, of the most troublesome characteristic of the compass, the so-called "northerly turning error." If one considers a plane taking a bank to turn from a north course toward the west, it is readily seen that the banked card will have a magnetic couple acting on it, tending to turn the card in the same sense in which the case which carries the reference or "lubber" line is turning. The same thing will hold for a turn from north toward east, and it is found that under some conditions the card will turn farther than the case, thus indicating a turn in the *wrong direction.* For a plane turning out of a south course, the card will turn in the opposite direction to the case and hence will exaggerate the amount, though this cannot lead to uncertainty as to the sense of the turn. Ambiguity only occurs for a turn out of the north. Lindeman's final conclusion is that under ordinary conditions as to speed a card having a period of from 40 to 60 secs. will not indicate a wrong turn, whereas with a period of 20 secs. or less the wrong turn will be shown.

The first experimental study of the behavior of aeroplane compasses, with approximate discussion of the cause, was carried out by the late Keith Lucas, who pointed out that, because of the lack of symmetry of the card, there is an accelerative force tending to make the south (counterweighted) end of the card point *away* from the axis of a turn. This conspires with the magnetic couple referred to above, and becomes very pronounced in a spin. If this is eliminated by using a symmetrical card with double pivot, the magnetic effect is sufficient to produce an ambiguity. The errors we have been discussing are only troublesome in case the compass is the only means of maintaining a straight course, in fog, or cloud flying, and then they will be exceedingly dangerous. While there is no doubt of the advantage of a long-period compass (R.A.E. Mark II, for example) as regards northerly turning error, it has the disadvantage of a slower recovery, and for this reason has not been as extensively used as it otherwise would have been. Fig. 8 shows the most recent English compass, the aperi-

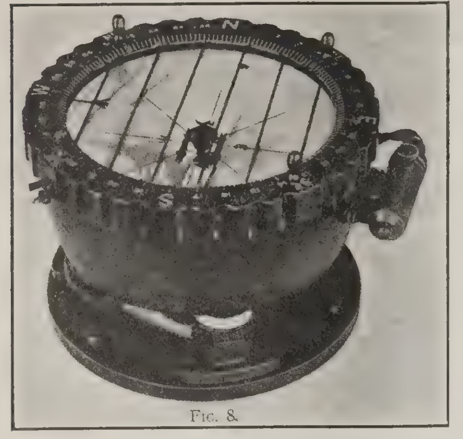


Fig. 8.

odic, evidently designed to combine the advantages of the two types, in which the mass of the card is reduced to a minimum and the damping relatively increased. I have seen no reports of its behavior.

Some early English reports laid great stress upon the desirability of having a perfectly spherical bowl in order to reduce the disturbing effects of currents in the liquid produced by rotation, but our experiments, and I think the later English ones also, showed that this was of relatively little importance.

There are still to be considered two most troublesome matters, the disturbance due to vibration and to magnetic fields on the plane. Vibration may not only produce a very annoying motion of the card, interfering seriously with the accuracy of reading, but also a steady deflection of from 2 to 15 or more degrees, depending upon the nature and the amplitude of the vibration, the method in which the compass bowl is supported, the shape of the pivot and cup, the form of the guard and the net weight on the pivot. The bowl must be supported so as to maintain its alignment and at the same time to permit a damped motion with respect to the ship. An elastic support without damping will not do. A compass which will work upon one plane may not work upon another, as we found to our cost. It is not necessary to go into these details but they must be studied carefully for each type of installation.

The magnetic troubles must also be studied for each type of plane and position of the compass, as they depend on the location of iron parts, and upon the type and position of the ignition mechanism. Compensation of the magnetic field due to the plane is very difficult, as they are likely to vary from time to time, and are partly due to induced magnetization which varies with the heading of the plane. This is particularly true of the pilot's cockpit next the engine of a high-powered plane having a battery-ignition system. It is desirable to check the results of "swinging ship" on the ground by tests in the air to determine compensation and vibration errors, and this requires special methods. Perhaps the simplest is by the use of a stabilized horizontal graduated circle with a vertical wire at the center, the position of whose shadow on the circle can be read off. This gives the apparent bearing of the sun with respect to the axis of the plane and from this, knowing the day and hour, the true bearing may be computed and compared with the compass bearings taken at the same time. Mr. Sterling demonstrated the accuracy of this method in many of our tests.

Turn Indicator.—While this instrument has not yet come into general use, it is sure to be of the greatest importance, for it relieves the compass of the second and most difficult demand upon it, assistance in holding a straight course. Two types have been developed: the first, depending upon the difference in air speed of the two wing tips during a turn; the second, using gyroscopic precession. In the first case two pitot tubes may be mounted, one at the tip of either wing, connected to a differential pressure-measuring instrument in the cockpit. It works out that the difference in impact pressure between the outer fast-moving wing and inner slow-moving wing tips is just twice the outwardly directed centrifugal pressure difference in the connecting tubes due to the rotation, hence the net pressure difference available for measurement is equal to the latter, and is quite small in amount. On a banked turn this is slightly reduced because the outer wing tip is at a higher level. A more sensitive arrangement would be to use venturi tubes in place of pitots, and we experimented quite a little with such an arrangement at Langley Field. In either case it is desirable to pivot the tube and provide a tail vane so that they head into the air stream. At best the venturi tubes, and to a less extent the pitot, gave irregular and fluctuating indications, and as regards sensitiveness, convenience, and small head resistance, the gyroscopic type is much superior.

Work with the gyroscopic type in this country was started by Dr. A. H. Compton, working in conjunction with the Air Service, on a device originally intended as a gyroscopic inclinometer,[2] but which proved to be unsatisfactory for this purpose and was redesigned for a turn indicator. We had been anticipated, however, by Prof. J. B. Henderson in England. The essential feature is a gyroscope mounted with its axis parallel to the floor of the ship, and arranged so that if, due to the turning of the aeroplane, one attempts to turn the gyro axis around a vertical axis, it will precess around a horizontal axis and thus indicate the sign as well as the rate of turning. To control the motion of precession, springs are provided which tend to keep the gyro frame symmetrical with respect to the case, and also some form of damping. Several forms of drive have been tried for the gyro, an airscrew with flexible shaft, air jets, and Doctor Henderson's form in which the rotor is itself the airscrew. With proper design extreme sensitiveness may be obtained, so that small angles of bank may be considerably exaggerated and, of course, the instrument will indicate unbanked turns as well. The design which we worked out, shown in Fig. 9, is perhaps the lightest and simplest, and most flexible, since the indicator may be placed at any convenient place, the small suction venturi being preferably in the slip stream. Doctor Henderson's is more rugged and has the advantage of being in a single unit. Furthermore, by the use of some form of integrating device he proposes to show the total change in course which has occurred since the last setting of the instrument. The value of a turn indicator in cloud or night flying is obvious, as it enables the pilot to fly straight, avoiding the turns and spirals which throw a compass out of commission. A turn indicator and a properly installed compass form a strong combination.

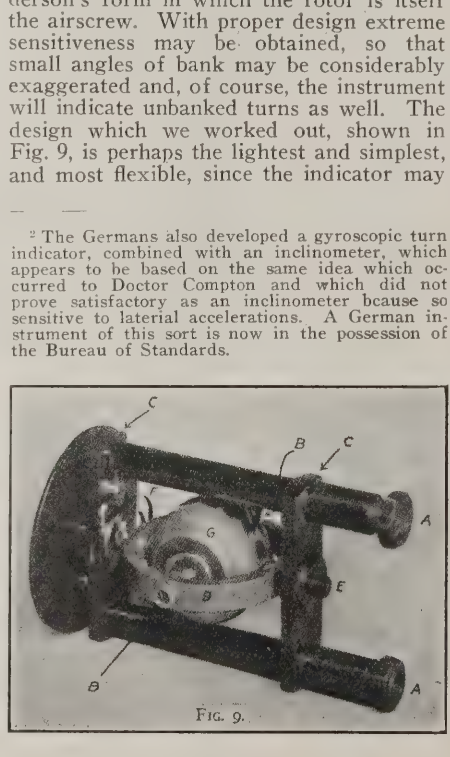
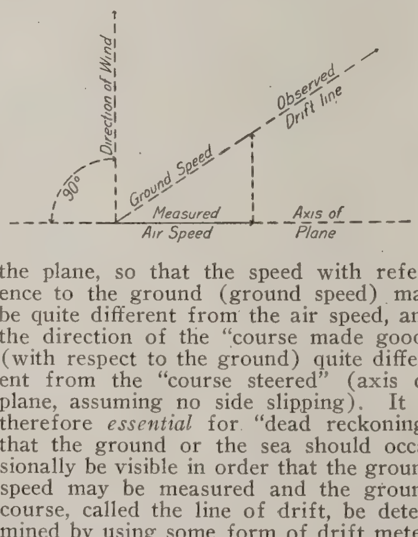


Fig. 9.

Turning now to the general problem of aerial navigation, it is obvious that it differs from that of ordinary navigation in two important respects: First, the addition of the third dimension, and second, the high velocity of the currents (winds) in which the vessel is moving. The method of handling the third dimension, altitude, has already been discussed, and the significance of the second factor must now be considered. Navigation in general may be carried on in two ways—either by the independent determination, by astronomical or wireless observations or otherwise, of successive positions, or by attempting to determine the *change* of position from a known starting point, *i. e.*, "dead reckoning." The latter involevs determining the direction of a course with respect to the ground and the speed over the course. In sea navigation the velocity of the currents (which correspond to the winds in the case of the aeroplane) is usually small compared to the ship's speed, and hence easy to allow for. On the other hand, in the case of air navigation the wind velocity may be as high as that of the plane, so that the speed with reference to the ground (ground speed) may be quite different from the air speed, and the direction of the "course made good" (with respect to the ground) quite different from the "course steered" (axis of plane, assuming no side slipping). It is therefore *essential* for "dead reckoning" that the ground or the sea should occasionally be visible in order that the ground speed may be measured and the ground course, called the line of drift, be determined by using some form of drift meter.

Fig. 10.



Drift Meter.—This may involve a wire, or series of lines on a glass plate, which can be rotated with respect to the plane axis until parallel to the apparent motion of objects on the ground, the angle of the line of drift with respect to the axis of the plane being then read. Or a series of radiating wires may be used whose angle with respect to the axis is known, as in Captain Webster's device, so that one can note the line along which objects drift. With the latter form the drift angle may be determined to 1°. At the same time the compass reading must be noted, and from these two the bearing of the drift line, or course made good, is at once obtained.

The ground speed may be determined in several ways, one of which is as follows: First, head the plane so that the drift is parallel to the axis, *i. e.*, fly up or down wind. Then, using the compass to deter-

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[2] The Germans also developed a gyroscopic turn indicator, combined with an inclinometer, which appears to be based on the same idea which occurred to Doctor Compton and which did not prove satisfactory as an inclinometer bcause so sensitive to laterial accelerations. A German instrument of this sort is now in the possession of the Bureau of Standards.

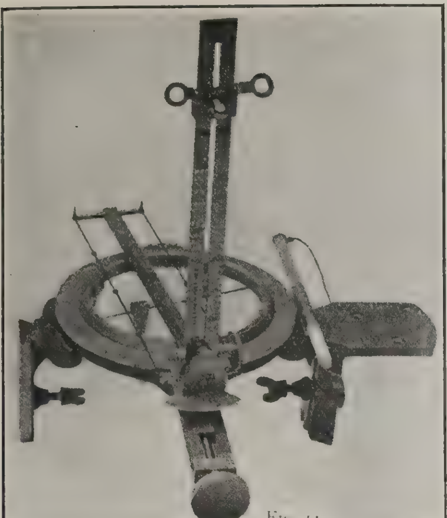
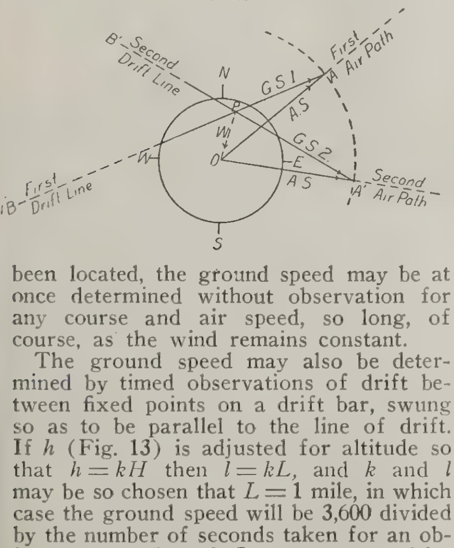


FIG. 11.

mine the angle, turn and fly at right angles to the wind and determine the drift angle. We then have a triangle (Fig. 10) for the mechanical solution of which several very ingenious devices have been designed, of which those of Major Wimperis may be particularly mentioned. The procedure of flying along and at right angles to the wind would in general involve considerable departure from any given course, which it is desirable to avoid. The wind-gauge bearing plate (Fig. 11) of Major Wimperis enables one to determine the ground speed by either of two methods without departing more than 25° from a given course. The geometry is as follows (Fig. 12):

If *AB* and A'*B'* are two traces of the drift on a transparent-bearing plate which is kept properly oriented with respect to the compass points, and if *AO* and *A'O* are in the corresponding directions of air speed, and proportional to these speeds, then we know that the wind vector must have one end at O and the other end on both *AB* and *A'B'*, and hence at their intersection *P*. *PO* is therefore in direction and magnitude (on the scale of *AO*) the wind velocity, and *AP* and *A'P'* the two ground speeds. The "wind point" having been located, the ground speed may be at once determined without observation for any course and air speed, so long, of course, as the wind remains constant.

FIG. 12.

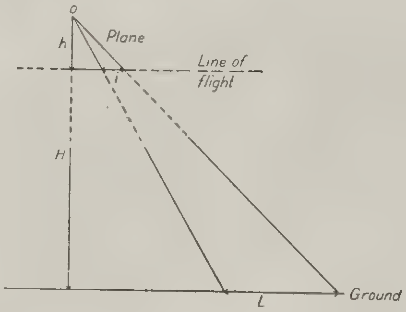


The ground speed may also be determined by timed observations of drift between fixed points on a drift bar, swung so as to be parallel to the line of drift. If *h* (Fig. 13) is adjusted for altitude so that $h = kH$ then $l = kL$, and *k* and *l* may be so chosen that $L = 1$ mile, in which case the ground speed will be 3,600 divided by the number of seconds taken for an object to pass along *l*. In many types of instruments scales are provided which automatically carry out this and similar computations.

Various other schemes have been proposed and tried as ground-speed meters, with the general object of reducing the calculation involved and increasing the accuracy. Some of the most ingenious, which have not yet been made practicable, involve a moving index or tape whose speed can be adjusted until it synchronizes with the apparent ground speed; the device could be graduated to read directly the ground speed, since if $h = kH$, then $s = Ks$, where *s* and *S* are, respectively, the index speed and ground speed. It should be remarked that for ground speed observations over the sea smoke bombs may be dropped to serve as reference points by day and flares by night.

Navigation by the determination of position, the only method available when flying over clouds, involves either astronomical or radio observations. For the former the primary instrument is the *sextant* which, for cross-oceanic flights, is likely to be of very considerable importance. Its use was the subject of careful experimentation during the war by Doctor Russell, Captain Webster and Captain Gault at Langley Field. The fact that the horizon is frequently invisible from the upper air, being obscured by haze, if not by clouds, makes it necessary to use either some form of stabilized mirror (artificial horizon) or a level or bubble sextant. At Langley Field a damped pendulum stabilizer and a form of bubble sextant devised by Dr. R. W. Willson were used, and both are subject to errors due to lateral acceleration. With careful flying the average error of a single observation amounts to only 13' of arc, but with ordinary piloting it is 26', while the average error of six observations is only 6', with careful piloting. While the accuracy of the two instruments was about the same, the bubble sextant proved to be the most convenient. When two heavenly bodies are visible, a location with an average error of seven miles may be made in ten minutes, using the natural horizon, and in twenty minutes with an error of fifteen miles, using the bubble sextant The British Air Service has developed a different type of bubble sextant, designed so as to permit the observer to look *directly* at the object observed instead of at the horizon, with the idea that in the case of stars at least, such an arrangement will make it easier to find the proper object and point on it.

FIG. 13.



Directional wireless is of great promise as an aid to aerial navigation, as well as to navigation of the sea, though the very large anomalies and uncertainties, amounting at times to 90° or more, which have been discovered and studied during the past two years at land stations, make it appear very doubtful whether long-wave transmission will ever be useful for this purpose. Short and discontinuous waves seem to give indications of direction reliable to perhaps 2°, but the use of short waves will very much limit the range. There is still the possibility, though not the probability, that the anomalies will be found less in magnitude in the air and over the sea. Directional wireless may be used in several ways. For example, the plane may send out a signal, which may be received by several direction-finding stations. The several bearings of the plane being collected at one station and plotted, the plane's position may be determined and sent back to it by radio. Again, the plane may carry a direction-finding set, the bulkiest part of which is the coil three or four feet square, with which the bearings of certain known stations may be taken, and from these the position of the plane may be quickly found graphically. In the case of smaller planes, it is necessary to fix the direction-finding coil with respect to the plane and turn the plane to face successively the various sending stations. In either case the compass, or a special neutral gyrostat with horizontal axis, must be used to give a fixed direction from which bearings may be taken, but either a compass or a gyro will maintain a fixed direction more accurately in a plane which is itself not turning, so that this as well as the greater ease and speed of observing is an argument in favor of the rotating coil whenever its use is possible.

Stabilizing Devices.—The primary purpose of all such devices is to indicate, or to adjust something to, the vertical. Hence the arrangement must be sensitive to gravity—hence no "neutral" gyrostat or "neutral" inertia body will do. A pendulum is the simplest form of vertical indicator—and for some purposes is very useful, especially if provided with internal instead of external damping, as has been done in various forms of gyroscopic pendulums. Doctor Duff's gyro damped pendulum bombsight is an example. An absolutely neutral gyro mounted in gimbals would of course be useless for our purpose, since even if it were initially given the correct vertical position, its tendency to maintain a fixed direction in space would soon throw it off because of the earth's rotation, or the motion of the aeroplane on the earth, or both. We must therefore have a gyroscope mounted so that there is a gravitational or other couple tending to keep the axis vertical. The less this couple, that is, the more nearly neutral the gyro, the more slowly will it respond to lateral accelerations—but also the more slowly will it return to vertical after being disturbed. But even with such a couple, if there were no friction in the gimbal bearings the gyro would not return if disturbed, but would *precess* around the vertical, a real gyroscope being gradually brought into the vertical by friction of the gimbal bearings. Hence various devices called "erectors" have been used to introduce a couple at *right angles* to the plane containing the axis and the vertical, which will restore it to the vertical when disturbed.

All of these involve in effect one or more free short-period pendula, and it is to the average vertical as defined by these that the gyro will tend to be set. As such a pendulum will quickly adjust itself to the "apparent" vertical it will, unless otherwise provided for, at once bring to bear a couple tending to move the gyro into line with the apparent vertical, the "erector" becoming a "disturber." In ordinary use it would be possible to keep the gyro axis at all times within, say, 8° of the *true* vertical, so that it would not be necessary for the erector to act beyond this range. Hence there would be an advantage in arranging to have the erector automatically cease to operate when the "apparent" vertical departed by more than, say, 8° from the true vertical. This may be very simply accomplished with some types of erectors. It would also be convenient to have means whereby either the gyro could be clamped, or the erecting mechanism thrown out of action when the disturbing forces were very large.

(*Concluded on page* 549)

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RUGGLES C
168 W. 73d Street

THE DESIGN REQUIREMENTS OF COMMERCIAL AVIATION

By GROVER C. LOENING

(Concluded from last week)

Influence of War Aviation

One hears much about the great number of years of progress the four years of war contributed to aviation. Such statements are surely made without a sincere study of the subject. In my opinion, war aviation hindered the development of commercial aviation for just that particular period and did still greater harm. It caused thousands of our young men to think of aviation in the terms of the battle front, where the disagreeable features of air fighting and that particular type of professional use of the aeroplane gave them an entirely different viewpoint than is needed for the stimulation of the use of the aeroplane as a pleasure vehicle. I know dozens of former war pilots who see no future advantage in flying. They cannot see that commercial peace-time flying will be entirely different.

During the war the details of construction that developed in simplification would, I believe, have developed more rapidly and with a more direct bearing upon commercial aviation, had there not been that tremendous military urgency, making it necessary for designers to compromise in innumerable instances upon the ready at hand 50 per cent correct detail, which would work well enough, in place of the ideal which they would have sought had they not been pressed for quick results by the greater emergency. For example, the simplest detail in an aeroplane is the seat; but in war aeroplanes today there is no really comfortable seat and certainly nothing that has had put into it the thought that has been put into seats in automobiles. From a war-aeroplane standpoint this is correct. From a peace-time standpoint the ignoring of such details is obviously wrong.

Since the war there has been great progress in working out some of these details required for the commercially successful aeroplanes. A survey of the progress that has been made in the last two years shows where we would have been three or four years ago in commercial aviation had we not devoted our energies to the military side. It is unfortunate if, as maintained here, with all the money spent during the war commercial aviation was not greatly benefited; but a review of the conditions serves to bring out some of the distinctions between military and commercial aviation more clearly.

One of the results of the feverish influence of the enormous aviation activity during the war was to start a commercial aviation campaign of overselling which threatened to wreck the whole industry. Because thousands of aeroplanes had flown over the battle front, of course it followed, in the minds of many people, that thousands of aeroplanes would immediately fly over the cities. The expected result failed to materialize, whereupon aviation was pronounced impractical by many. As a matter of fact, between these two extremes the really sound use of aeroplanes here and there in an entirely practical way that is possible and would, if followed, lead to a thoroughly solid, conservative development, was rather swamped in the rest of the noise. As a corollary of this state of affairs, many attempts at great flying demonstrations were carried out over bad country and, therefore, accompanied by serious accidents. A year of this, in which the number of fatal accidents was great, is taking years of patient effort to efface and, as stimulating public interest and helping the aviation business, it was devoid of helpful results. In other words, it would be far better for the aviation industry to go all the way to the other extreme and never fly unless a safe performance were absolutely certain.

How beneficial such policy can be was shown by the change in the plans for the Pulitzer race. It was originally intended to fly across the continent, in a manner that would not have permitted proper organization of flying fields for safety, and presumably would have resulted in many serious crashes Instead, it was very wisely decided by the Aero Club of America to hold the race over a short circuit of flying fields situated on Long Island, an ideal flying race-course. The result was that, with about a dozen machines coming down in forced landings, there was not a single serious accident. The reason was that practically all of these machines landed on flying fields, or on fields that permitted of reasonably safe landing. There was a very widespread realization, on the part of a vast multitude of people who had seen the race, of the fact that after all aviation is not so dangerous, and this was expressed in editorials in papers throughout the country. The dangers were exactly the same as in any other race, but disaster was not courted as it had been theretofore.

Questionable Future Developments

The future developments spoken of at present which possibly are apt further to mislead commercial aviation can be considered briefly:

(1) Are the higher-powered engines, that many are interested in, being developed along the right lines?

(2) Is the introduction of complications, such as variable camber and retractable running-gear, really necessary?

(3) Are the new "high-lift" wings so important?

(4) Is an "aerial tramp" desirable?

Commercial experience to date seems to indicate that higher power is not needed as much as greater reliability. The loads on commercial machines are becoming so high in proportion to the weight of the engine that 100 pounds more or less is not a serious difference and can very well be afforded if increased reliability can be obtained thereby. It seems that new ideas in engines are not as requisite as consistent perfection in the details of what we have, I mean details of installation that are admittedly bad and could be made better if the engine were simpler to install.

A slight increase in speed is obtainable by drawing the running gear up into the body and by flattening out the camber, but a point to bear in mind is that variable camber does not give higher lift than a "high-lift" wing-section. The point is difficult of argument in the abstract. The innovation is undoubtedly worth trying but, as in the case of many other things on aeroplanes, to justify itself the complication will have to show far greater advantage than it seems it will show. It is not likely that with the engines available commercial aeroplanes will run much over 120 m.p.h.; so, let us examine a landing-gear representing a total head resistance of approximately 57 pounds at this speed on a 5,000-pound aeroplane of 400 h.p. Without any increase in weight, the retractable feature would reduce the head resistance by this amount and cause the machine to speed up 2.3 m.p.h. But if the head resistance of the land-gear itself is halved by modified and more careful design, it is obvious that the advantage of the retractable feature will become almost negligible. In other words, is it not likely that simplicity and refinement of what we have will give a neater landing-gear of fewer parts and perhaps less weight, as against taking our present clumsy landing-gear, admitting its clumsiness to be unavoidable, and adding the complication of hoisting it into the body? For a small racing machine the landing-gear saving is of much higher proportionate value, due to the small size and weight of the aeroplane.

Concerning the new "high-lift" wings, we hear much today about various wings guaranteed to give enormous lift, the statements being accompanied as usual by prediction that our old friend the "problem" has been solved. In none of the data presented on these high-lift wings, such as those for the Handley Page, are any figures given as to the increased weight of the aeroplane, due to the much greater weight of the wing structure, which will very likely be found necessary to make these new types of wing as strong mechanically as the present ones and capable of being operated in the air. I venture to predict that 50 per cent or more of the increased lift claimed will be used up in the load added to the dead-weight of the aeroplane, due to a heavier structure. Certainly, one thing must be admitted; any such complicated construction will be more expensive and require more maintenance. Here again we see a false lead, perhaps swamping a sensible development, that is to take our present wing structure and modify the curves themselves so as to get a high-lift wing-section. This is being done already by many constructors, and incidentally in many cases with marked success. It still appears possible to modify the curve of the rib and gradually improve the depth of the wing for ample spar room, without any serious increase in the resistance and yet with a higher and higher value to the lifting coefficient. Development in this way will follow closely the same trend as the development of the lines of hulls of boats followed, resulting in gradually decreasing their resistance per horsepower for a given buoyancy.

By "aerial tramp" is meant a slow load-carrier. It is almost certain that aeroplanes will be load-carriers. But, will they be slow? The whole idea of using them to carry loads is to exceed the speed of a train or boat; warranting the higher expense. We should look forward to the time when high-class express and passenger traffic will be carried by air, with the railroads devoting themselves to the heavy freight about which there is no great hurry. The competition in load-carrying can be expected to be keen, particularly when it is realized how long cheap freight haulage has maintained its volume of business against the express. Apparently there is a minimum load for a commercial aeroplane; namely, eight or ten passengers, or 1,000 to 2,000 pounds of goods. Since the entire object of commercial aviation is to provide transportation at high speed, is it not likely that the development will be along the lines of carrying this load at higher and higher speed, rather than more and more load at the same speed?

Desirable Future Developments

Among the modifications to aeroplanes that can be looked forward to as highly desirable and much needed for the advancement of commercial aviation is durability of construction. In this should be included the reliability of operation of the engine as the foremost necessity. Mention has already been made of the fact that increased durability of the structure of the aeroplane itself, is apparently obtainable by simplification when wood is used, and by the use of steel tubing in the fuselage and other parts such as the control surfaces and landing-gear. In the wooden construction there must be eliminated the fussy glued-up parts, tacked together with pieces of veneer which, when they soak up water, begin so readily to open seams, or when stored for a long time not only warp but in many instances because of the peculiar glue used start a deteriorating sort of fungus growth. A good healthy piece of wood will last as long on an aeroplane as on a boat and, taken hold of by a simple and accessible metal fitting, can be expected to give ample durability. Then, too, in the interest of durability, aeroplanes should receive some care. Is it too much, for example, to ask that they receive the same care as yachts or high-class motor cars receive? Is it shocking to see the condition of some commercially used aeroplanes; one marvels not at their lack of durability but that they can be flown.

As long as the delicate part of the aeroplane, the engine, needs the attention which it certainly must have, it is not a difficult matter to clean and polish the structural parts of a machine. Our present construction, therefore, with a little more steel framing used, with the wooden parts few in number and made large and solid, and, above all, with the construction accessible for inspection and cleaning, appears to offer plenty of durability for commercial purposes.

There are many desirable features to be looked for in the development of the power plant; for example:

(1) Muffling devices to deaden the noise of the engine.
(2) Gearing, or geared-down engines or, better still, slower running engines to improve the propeller horsepower by increased efficiency, particularly at getting-off speeds and climbing speeds.
(3) Further development of the reversible-pitch propeller.
(4) Finally, the development of what now seems to be an ideal aeroplane engine.

The necessity of mufflers need hardly be dwelt upon, because there is nothing more disagreeable or that robs flying of more of its charm than the incessant noise of the engine, this being the cause of a nervous strain that unconsciously makes people dislike flying without exactly knowing why. An ordinary motor-car muffler may not be readily applicable to an aeroplane engine, due to the enormous volume of gases that has to be handled as compared with the lower-powered motor-car engines, but the exhaust of an engine has an energy, the firing off of which into the air can be delayed by many means, and can even be made useful in deriving some slight additional power or, as in the case of some super-chargers, in driving a mechanism for some other purpose. Next year, after some of the new developments on the muffling of aeroplane engines shall have been more fully worked out, we may find that this problem will have been solved in an efficient manner involving relatively little weight.

The use of gearing is a difficult matter; that is, the gears must be pretty tough to stand it. The big problem appears to be the heat transfer. The loss of power in the gears is represented largely by heat. In the high-powered engines this means that an enormous quantity of heat must be taken away from the gears. Various oil-cooling devices have been experimented with. Some of them work, but the weight of the gearing is still high, ranging from 1 to 1½ pounds per horsepower. A detail like this, however, can be developed only by persistent hard work in eliminating defects. Many people are working with this in view, particularly in Europe. The ultimate aim is, of course, to derive an aeroplane with an engine-room such as one has on a boat, with the engine accessible at all times and permitting minor repairs during the flight. It is not easy to state whether gearing justifies itself, for the simple reason that really successful gearing has yet to be developed.

The reversible-pitch propeller will probably make it possible to land an 80 m.p.h. landing speed aeroplane in the space where a 40 m.p.h. machine lands today. Conversely, due to the variation in pitch available, there is a higher thrust at slower air speeds, thus offering more power for acceleration and therefore giving a quicker get-away and climb for getting out of small fields with a fast machine. It is very convincing to see an aeroplane with a reversible-pitch propeller come down for landing in a normal manner and, just after wheels make contact with the ground, when the long roll to the other side of the field begins, observe the reversible-pitch propeller come into play and slow the machine up quickly.

To put down in specifications what would be an ideal aviation engine for commercial purposes is almost impossible in the present state of the art. We have an S. A. E. committee in the proceedings of which it is ruled that if two aeronautical engineers actually agree on any one point, the verdict concerning it becomes unanimous. In other words, every designer seems to have his own favorite hobby. Some features, however, can be stated as covered by considerable agreement among constructors and operators of aeroplanes. For example, the simplest smoothest-running engine is a six-cylinder vertical. It is narrow and has comparatively low head resistance and its length is not serious in a commercial machine. It is simple and accessible. But the trouble with our present six-cylinder types of engine is that they are either too low-powered or operate at too high a speed. If the aeroplane designer could have a 300 h.p. engine turning at 1,000 to 1,200 r.p.m. he would have not only a higher propeller efficiency without gearing, but the slower engine speed would make the use of a reversible-pitch mechanism easier and the propeller less noisy.

Some constructors are greatly in favor of very high-powered engines, but there is fairly general agreement that for a commercial aeroplane at least 300 h.p. is necessary. The advantages of gravity feed for the fuel are obvious, so the ideal engine must have its carbureter low, facilitating gravity feed. Whether battery ignition or magneto ignition is used does not bother the aeroplane man very much, except that with battery ignition it apparently becomes slightly more economical to install an electric starter, which is much to be desired. But the spark-plugs must be in a position where they can be removed very readily, and the ignition parts must be so placed that they can be protected from dampness and readily opened up and cleaned. The carbureter must have a far healthier and larger filter than any of them has at present. No matter how careful one is with fuel lines, there is always the possibility of dirt getting down to the carbureter, with the consequent danger of clogging the needle-valve. The ideal aeroplane engine for commercial purposes should also carry its oil and all the connections that have to do with it in the engine, and have incorporated in its design a centrifugal oil-cleaner.

The engine, as already pointed out, must be equipped with mufflers. Furthermore, when we consider the radiation system, which has been a bete-noire by actual statistics, on over 85 per cent of the aeroplane types developed to date, we find incompetent work on the part of aeroplane and engine people alike. The fact of the matter is that many of the faulty radiation systems that exist are faulty only because they have really never been tested properly. The engines are run through their endurance test of fifty hours, but with a water barrel holding perhaps 25 gallons of water, many feet above the top of the engine, giving a condition of circulation in the engine that is not at all similar to that of the aeroplane's system. When fifty-hour tests are made on a power plant in the future they should be made on a complete power plant, in which the radiation system, as actually intended to be used, is considered fully as important as any other system. As a matter of fact, there is considerable question as to where the design of the radiator and its connections should be left to the aeroplane constructor to work out.

Given an engine of the above characteristics with its six big cylinders, the aeroplane designer can afford to offer to use this engine with considerable enthusiasm, even if its weight for 300 h.p. is as high as 1,400 pounds, or twice the weight of present 300 h.p. engines. With an engine of this weight it would be possible to fly a 5,000-pound aeroplane at well over 100 m.p.h., carrying at least 1,500 pounds of useful load. The sacrifice of a passenger or two, due to the heavier weight of the engine, is a minor matter compared to the increased reliability that it would be possible to obtain with the heavier weight allowance. Furthermore, there is even a more important consideration in that the heavier engine will be very much cheaper to build and not require extraordinarily fine materials.

In conclusion, is it not possible in a résumé of design characteristics and requirements for commercial aviation to place many developments in their proper category by emphasizing that all-metal construction is a secondary need, a gradual development in itself already resulting in partially metal construction; that in structural features what is needed is great simplicity and refinement in the reduction of the number of parts and fittings, whereas in the engine and installation we have simply to go along our present lines a little more consistently and patiently to obtain that element of reliability which is more important than any other element in connection with aeroplane construction.

FOREIGN TECHNICAL DIGEST

Possible Line of Developments in Aircraft Engines

This paper, by H. R. Ricardo, was read before the Royal Aeronautical Society of London and reviews the present state of the art and suggests feasible methods for increasing the efficiency of existing power plants.

"In aircraft engines when one is working over a large range of atmospheric density the question always arises—at what density the engine shall be designed to give its best performance or at least to develop its full power. Until comparatively recently all engines were so designed that they could develop their full power at ground level, without pre-ignition, without overheating, and without overstressing the parts. During the war, however, it became evident that this was unnecessary and undesirable, and manufacturers were urged to design their engines on the assumption that they would not be opened full out below 10,000 feet. So far as the writer is aware, no manufacturers actually produced such an engine. It is, however, interesting to consider what might be done in this direction. We will begin with the assumption that modern aviation spirit has a toluene value of 10, which is about the average value of American aviation spirit. At 10,000 feet the air density is 0.72, and at this density a compression ratio of 7.0:1 could be used with such a fuel, giving a theoretical limiting thermal efficiency of 38.8 per cent and a theoretical limiting mean pressure of approximately 165 lbs. per square inch reckoned at ground level or 119 lbs. per square inch at 10,000 feet. Under these conditions let us now consider what power the engine could develop at ground level, keeping just free from detonation. If controlled by throttling the maximum indicated mean pressure would be approximately 95 lbs. per square inch. If controlled by varying the time of closing of the inlet valve it would be considerably higher, because for various reasons the efficiency obtainable under these conditions is greater and would be very nearly in the ratio of 5.25 : 7.0 × 165 (5.25 being the limiting ground level compression ratio for a fuel of toluene value 10) or say about 122 lbs. per square inch. If controlled by the addition of cooled exhaust gas the mean effective pressure, as shown previously, would be very nearly equal to the full available M.E.P. with a compression ratio of 5.25 : 1 or 140 lbs. per square inch.

In all cases let us assume that the mechanical losses of the engine are equivalent to an M.E.P. of 15 lbs. (a fair average figure). Then the theoretical limiting brake mean pressure in the three cases would be: (1) 80 lbs. per square inch; (2) 107 lbs. per square inch; (3) 115 lbs. per square inch, *while at* 10,000 *feet the brake M.E.P. will be* 104 *lbs. in all cases.*

In all three cases the explosion pressure would be substantially the same, and little or no higher than at 10.000 feet—that is, about 450-500 lbs. per square inch. In the latter case it will probably be actually lower, because the principal effect of the exhaust gas is to slow down the rate of burning and so round off the peak of the diagram. Assuming that the propeller torque varies as the square of the speed and directly as the density, then, if the engine is designed to run all out at 10,000 feet at 1,500 r.p.m., its maximum speeds at ground level will be approximately 1,100, 1,270 and 1,320 r.p.m. respectively. In the former case such an engine would probably fail to leave the ground.

From these considerations it seems clear that the principle of designing a very high compression engine for use at high altitudes and throttling it on or near the ground is not the right one. Of the three methods considered, the use of exhaust products appears to be the most hopeful as a means of permitting a very high compression engine to operate satisfactorily at low altitudes, and still have sufficient power to get rapidly off the ground." (*Flight,* December 30, 1920, 5½ pages, 14 diagrams and 1 illustration.)

Early Balloon Experiments

In this article M. Charles Dollfus describes some of the very early experiments in balloon and dirigible construction and reproduces some interesting data which has not been published in any other aeronautical journal. (*L'Aeronautique,* November-December, 1920, 6 pages, 7 illustrations.)

Development of Aero-Engines Since 1914

In this article the author gives a description of the 185 h.p. B.M.W. engine.

The special carbureter and its characteristics are treated at some length. Due to its high compression (6.3), the engine will run satisfactorily on very weak mixtures on the ground, and the carbureter is not fitted with an altitude control. The throttle characteristics of the engine are interesting, and are given below:

R.P.M.	H.P. at propeller	Consumption gm. petrol-B. H.P. hr.	Consumption pints-B. H.P. hr.
1,400	200	187	.461
1,300	163	190	.465
1,200	128	195	.475
1,100	95	190	.465
1,000	70	212	.520
900	54	265	.650
800	48	350	.860

The efficiency at 1,100 r.p.m. is thus practically the same as at full throttle, and cruising speeds of the machine are extremely economical, as full advantage is taken of the increased aerodynamical efficiency. (Dipl.-Ing. O. Schwager, *Illustrierte Flug-Welt,* July 21, 1920. 12 cols., 2 diagrams.)

Semi-Diesel Engines

This article, on the operation and construction of semi-Diesel engines, gives the experiences of the author during twelve years' running of these engines.

The best material to use for bulbs is "cast wrought-iron." Cast iron and cast steel bulbs frequently crack. Cracks repaired by welding are unsatisfactory; small cracks can be made gas-tight by the use of a strong solution of sal ammoniac and cast iron filings. Fuel pumps require careful attention. Equalizers give trouble, and should be removed or blanked off. Drip pans should be fitted under pumps. Circulating and bilge pumps should have effective strainers and mud traps, and more attention should be paid to lubrication of pump parts.

Crankcase air valves are, as a rule, badly designed. Leather valves are bad. Multiple metallic valves, circular or thin strips, with small lift and spring held, are best.

More care should be paid to the position of crankcase drain cocks, and these should not be in such a position that the crankcase can fill with water from the bilge if left open. Air-starting valves should be designed so that they may be removed and cleaned while the engine is running. Lubrication arrangements, as a rule, are unsatisfactory and the cause of many breakdowns. Mechanical sight-feed lubricators are best for pistons and small working parts, and positive pressure feed should be fitted for main bearings, big ends, and small ends.

Welded fuel tanks are better than riveted ones, and rarely leak. They should be fitted with man-holes, hand-holes, and strainers, and air vents should be provided. Air bottles must be fitted with drain-cocks.

Epicyclic reverse gears are best; cone or expanding clutches are better than disc clutches. Reversing propellers are, as a rule, excellent. (*Motor Boat,* Nov. 12 and 19, 1920. 3 pp.)

Lubrication of Internal Combustion Engines

An examination of the different kinds of lubricants employed and the various means of applying them.

At ordinary temperatures the oil should be fluid enough to circulate easily in pipes of small diameter, and at high temperatures the viscosity should be sufficient for lubrication between piston and cylinder and should not carbonize at the moment of explosion. Mineral oils are too fluid, but do not carbonize very much, whilst vegetable oils carbonize too much under the influence of high temperature, acids and glycerine separate out, and cause harm to the bearings. Castor oil is used almost exclusively on aero engines, as it resists high temperatures, and has a very low freezing point, but it is not a neutral oil, and is high in price. Usually a mixture of mineral and vegetable oil is used in motors. The flash point should be from 230°—280° C., and the density not above .920. A suitable lubricant depends on many factors, *e.g.,* piston speed, method of lubrication, etc.

In forced lubrication oil pressure should not exceed 2 kg. per square mm. The oil pump should be placed at the lowest point of the crank case. The author discusses the suitable lubrication of various parts of the motor. (F. Acher, *Automobilia,* Nov. 15, 1920. 2¾ pp., 4 figs.)

Post War Super-Aeroplanes

This article is an interesting and useful summary of post-war designs of large German aeroplanes, particulars of most, if not all, of which have already appeared in these columns The machines described include Zeppelin Staaken, Siemens-Schückert, D.F.W., Aviatik, A.E.G., Linke-Hoffmann, Dornier-Zeppelin hydroplane, Oertz flying-boat (Austrian). (*La Nature,* Oct. 30, 1920. 18 cols., 22 figs.)

NAVAL and MILITARY AERONAUTICS

Taxied NC-5 Through Gale

San Juan Del Sur, Nicaragua, Jan. 20.—Lieut. H. V. Baugh, commander of the seaplane NC-5, which was wrecked and sunk when it ran into a hurricane last Saturday about forty miles north of this city during its attempted flight from San Diego, Cal., to Balboa, Panama Canal Zone, told of his experience to-day. The seaplane was one of the twelve which left San Diego December 30 for the Canal Zone.

"When we ran into the hurricane on Saturday our engine was giving trouble," he said. "The wind was blowing about forty-five miles an hour and the plane was flung about like a boy's kite. Eventually it fluttered to the surface of the sea about twenty miles from land. We 'taxied' to the beach under tremendous difficulties in the very teeth of the storm, striking the coast twenty-five miles north of Gigante, where the NC-6 also arrived eventually after radiographing to the ships following us the position of the NC-5.

"The Kanawha arrived and took the NC-5 in tow, later handing it over to the destroyer Munford. The latter took the crew aboard and continued towing the seaplane. The line parted frequently owing to the heavy sea, the NC-5 eventually sinking."

Navy Plans to Use Catapults for "Taking Off"

Washington.—Naval aeroplanes, instead of "taking off" from the decks of ships while at sea, will be hurled from catapults, if experiments of the Navy Department prove successful, the House Naval Committee was told by Captain T. T. Craven, Director of Naval Aviation. Tests are being made, he said, at the Washington Navy Yard, where it is planned to shoot a seaplane from a catapult soon to see if the plan is feasible.

Captain Craven said he was convinced the new method would prove superior to present attempts to get under way from decks limited in size.

The navy is attempting also to construct collapsible planes, the committee was informed, so they can be taken down and stored on board during bad weather at sea. The present system of keeping planes on top of the turrets, Captain Craven said, has proved unsatisfactory, as they are in the way and obstruct vision.

An appropriation of $35,000,000 has been requested for naval aviation during the coming fiscal year. During that time, the committee was told, the navy's station at Hampton Roads will become the most important aviation operating base on the Atlantic coast.

Further improvements, Captain Craven said, are planned at San Diego, Cal., the main base on the Pacific. He urged that a "considerable sum" be expended on the Coco Solo station at the Panama Canal in order to protect "the canal adequately."

Atlantic and Pacific Fleets Join

Balboa, Panama, Jan. 20.—The Atlantic Fleet passed through the Panama Canal and joined the Pacific Fleet to-day.

The fleet with its seaplane division arrived at Colon. The completion of the trip by the seven seaplanes marks the first air voyage between Philadelphia and the Canal Zone to be completed.

The seven battleships of the fleet anchored in Gatun Lake preparatory to their voyage through the canal a few hours after the seaplanes had made their landing. One plane made a forced landing on Serrano Bay, about 200 miles off the Nicaraguan coast; but the seven others made the flight without mishap.

The seaplane squadron left Philadelphia on December 16 and flew to Guantanamo via Key West. A month later they flew to Kingston, Jamaica, and from there to Old Providence Island. The final jump to Colon was made without difficulty.

U. S. N. Air Detachment at Howden, England

The detachment of 15 officers and 45 men are now at Howden, England, and their course includes the care, maintenance and operation of rigid airships.

When the ZR-2 is launched early in the year our Naval Air Detachment will be entirely competent to take care of her during her trials and to bring her safely to America after acceptance by our engineering experts, Comdr. H. T. Dyer, U. S. N., now at the Bedford Royal Airship Works; Comdr. L. H. Maxfield, U. S. N.; Lieut.-Comdrs. V. N. Bieg and E. W. Coil, U. S. N. The commissioned personnel in England in connction with this detachment are as follows:

Comdr. L. H. Maxfield, U. S. N., commanding officer; Camdr. H. T. Dyer, U. S. N.; Lieut.-Comdr. V. N. Bieg, U. S. N.; Lieut.-Comdr. E. W. Coil, U. S. N.; Lieut. F. P. Culbert, U. S. N.; Lieut. H. W. Hoyt, U. S. N.; Lieut. R. W. Pennoyer, U. S. N.; Lieut. C. G. Little, U. S. N. R. F.; Lieut. T. B. Null, U. S. N. R. F.; Lieut. J. B. Lawrence, U. S. N. R. F.; Lieut. A. R. Houghton, U. S. N. R. F.; Lieut. M. H. Esterley, U. S. N. R. F.; Lieut. W. R. Taylor (MC), U. S. N.; Lieut. J. H. Kyger (SC), U. S. N.; Ensign J. H. Hykes, U. S. N.; Ensign W. J. Medusky, U. S. N., and Ch. Mach. S. S. Halliburton, U. S. N.

Aeroplane Radio Direction Finding

In view of the coming extensive use of radio direction finding in the Air Service in connection with cross-country flying, results of experiments conducted by Engineering Division, McCook Field, as to the accuracy that may be expected will be of interest to all branches of the Air Service.

Experiments were conducted by the Engineering Division during the past summer using radio as a means of assisting aeroplanes to return to the home aerodrome. Results of these experiments have shown that it is possible to guide an aeroplane with absolute accuracy to any radio transmitting station, and further that an experienced operator is not needed for this work.

The method used was that of two closed loops mounted on the wings of an aeroplane at right angles to each other, and operating upon a maximum signal. The particular installation used was mounted on a Curtiss NJ-4-H aeroplane, and consisted of two main or "fore and aft" loops of four turns each, connected in series, one loop being mounted on the outside struts of each wing. The auxiliary loop consisted of four turns of wire and was mounted at right angles to the main loops, struts numbers 4 and 10 being used. The fuselage of the aeroplane was enclosed by this loop. The wire was sewed into fabric and the strips of fabric were doped on to the struts and wings of the aeroplane. Leads were brought from the loops into the rear cockpit of the aeroplane and there connections were made to suitable switches, condensers, amplifiers, etc.

When flying at a height of 2,000 feet it was possible to guide the aeroplane exactly over the transmitting station. This was done while allowing the man operating the switches in the rear cockpit to control the rudder, and thus steer the aeroplane as he desired. This experiment was tried both with experienced radio men in the rear cockpit and with men who knew absolutely nothing of radio and who did not know the Morse code. Results were the same in all cases—the aeroplane was brought directly to the transmitting station, no note being taken of the course steered from other than a radio standpoint. When flying at 2,000 feet it is possible for the operator to easily detect when the aeroplane passed as small a distance as 100 feet from directly over the transmitting station.

These experiments do not embody any new departure in radio direction finding in aeroplanes. The method used was a part of the method brought out in England during the war, and which was to be used for navigating the Handley Page night bombers of our Air Service. These experiments are cited merely to show the degree of accuracy which may be obtained when using this method of radio direction finding for guiding aircraft.

Preliminary Training Course at A. S. Mechanics School, Kelly Field

The addition of a course of mathematical instruction to every course taught in this school marks another advance in air service instruction. This course, known as the Preliminary Training Course, is of four weeks' duration. It is a short course in elementary mathematics up to and including the principles of algebra and geometry, sandwiched in with some intensive military training. Every student entering this school for a course of instruction must first complete this elementary work before he specializes on a branch of aviation. The military training is directly supervised by a commissioned officer and is given by a number of picked non-commissioned officers, none of whom has had less than 10 years' military service. This military work includes Infantry Drill Regulations, including "School of the Company," Interior Guard Regulations, lecture work on Army Regulations, Manual of Courts Martial, Personal Hygiene, Discipline, and other subjects which a recruit needs to know. This course is compulsory, and men attending it are excused from all other duties. It is believed that the addition of this course will mean a material gain in the school's efficiency.

FOREIGN NEWS

Aeronautics in Honduras

The Government of Honduras recently purchased a Bristol Scout and have made a contract with Ivan Dean Lamb and Gaston de Prida to instruct military cadets in aviation. It is also expected to utilize the machine for aerial mail purposes, and plans are now developing for the preparation of suitable landing fields throughout the Republic.

Japan Plans for Big Aerial Defense

Tokio.—The Navy Department has prepared a scheme for aerial defense according to which by March next the Yokosuka naval port will have 52 seaplanes, 11 balloons, 11 aeroplanes and 22 training aeroplanes. Forty seaplanes will be based at Kure, 52 at Sasebo and 100 at Maizuru. Arrangements are also being made to carry one or two aeroplanes on each warship attached to the battle fleet. National aeroplane workshops are being established near Hiroshima, and a large training aerodrome will be located at Lake Kasumigaura, a large inland lagoon about 30 miles from Tokio. Training will commence here when the English naval instructors from England arrive next spring.

British Imports and Exports by Air

In a statement recently issued by the British Air Ministry, the volume of goods carried by air in October and November, 1920, was shown to be about four times that of the same two months in 1919, the imports having increased from £44,077 to £172,332 and exports (including re-exports) from £22,987 to £109,831.

Among the many different kinds of merchandise transported the most prominent are articles of clothing, furs, jewelry, cinema films, perfumery and mechanical components. The bulk of the imports came from France.

An Air Board for South Africa

The South African Government has now appointed an Air Board to deal with aerial legislation, the development of aeronautics in South Africa, and with proposals for the establishment of mail and passenger services. The board is constituted as follows: Sir Wm. Hoy (Chairman), Sir Robert Kotze, Sir Roland Bourne, Messrs. H. W. Twycross (Postmaster-General), A. D. Lewis (Director of Irrigation), G. O. Smith (Commissioner of Customs), with Mr. A. C. McColm acting as Secretary.

Air Raid Damages

According to a return issued by the London County Council, 524 persons were killed, 1,264 injured, and direct damage was done to property to the amount of £2,042,000 by air raids during the war. In the metropolitan area 270 incendiary bombs were dropped and 52 fires caused in the county.

Australian Agency

Pratt Brothers, who have established the Geelong Air Service in Victoria, Australia, are seeking agencies for aeroplanes, seaplanes and parts, aero engines, timbers, fabrics, dope, small parts, etc., as well as wood-working machinery and aviation instruments and accessories. Their aerodrome is at Geelong, Victoria, Australia.

R. A. F. Ensign

The design for a Royal Air Force ensign has been approved by His Majesty the King. It consists of a flag of Royal Air Force blue, one-fourth of which is occupied by a Union flag as in the maritime ensigns. The fourth below the Union flag bears no device, whilst centered in the remaining half of the ensign is the Royal Air Force identification mark carried by all British Service aircraft.

The Union flag in the corner of the ensign denotes its nationality, whilst the colour and the marking serve to identify it as the ensign of the Royal Air Force. The inclusion of the Royal Air Force marking, which has become so familiar to all as the recognition mark on British Service aircraft, is appropriate in that it is the symbol under which many thousands of gallant actions have been fought in the air.

German's New Anti-Aircraft Gun

In connection with the resignation of the French Minister of War it is stated that the French Intelligence Service ascertained that among the new types of machine-guns evolved by the Germans was a heavy machine-gun for use against aeroplanes flying low over the infantry lines, and also against tanks. It was tested in August, 1918, at the trial grounds at Ham. The two barrels moved together, but were controlled by a single trigger, which in one model was placed between the barrels and in another beneath the right barrel. It was swung on a pivot mounted on a heavy stand.

Although in the final German retreat in 1918, the battlefields were scoured in search of these new types of weapon, none was ever captured, and none was among the 125,000 machine-guns surrendered under the terms of the armistice. The French Government possess reliable information that they have been further improved and manufactured. It is this knowledge which, in part, prompted M. Lefèvre to resign rather than to agree to the proposals of his colleagues for the reduction of the French Army under the new bill.

More Hidden Stores in Germany

From a message emanating from Detmold (Lippe) it appears that aviation stores to the value of a million marks were discovered on December 15, in a wood near Bad Salzoflen. Evidently the stores, including eight large crates containing 8 aeroplane motors, propeller parts, etc., formerly belonging to the army, and ordered to be destroyed by the Inter-Allied commission, were to be removed elsewhere. They were all seized by the authorities.

Hungarian Air-post Stamps

The development of trans-Continental air services has led the Hungarian Government to provide some new stamps for use on air mails. These have been created by surcharging new values on the 10 kronen violet-brown "Parliament" stamps of 1916-17 (inscribed "Magyar Kir. Posta"). In addition to the new value the words "Legi Posta" are overprinted. The values and colors of the overprints are: 3 kronen in green on 10 kronen, 8 kronen in red on 10 kronen, 12 kronen in blue on 10 kronen.

Commercial Aviation in Sweden

The Swedish customs authorities are now issuing monthly returns of aerial traffic. According to the October return 30 foreign aeroplanes arrived loaded and six in ballast, while 19 left loaded and 17 empty. It is stated in Stockholm that the Northern Aviation Co. has purchased four British aeroplanes, two of which will be flown across by Mr. Hawker and Major Johnstone respectively.

Air Liner as Ambulance

One of the Vickers-Vimy machines of the Instone Air Line was called into service as an aerial ambulance on January 3. Two paralyzed officers, Messrs. Bibby and Hayde, were not in a fit condition to travel to the Riveria by the ordinary method of boat and train, and the aeroplane was specially fitted for the journey. Travelling with the invalids were a doctor, a nurse, and an attendant, and with other passengers, two pilots, and a mechanic the number of people travelling was ten. During the whole of the time the machine was in the air wireless telephony was in progress. The first stop was at Paris.

London-Birmingham Air Service

Owing to the continued bad weather, Messrs. Handley Page's experimental air service from London to Birmingham had to be postponed. On Wednesday, December 22, however, as the weather conditions were considered favorable, the first aeroplane to fly in connection with the new service left the Cricklewood Aerodrome with passengers and freight. In order to commemorate the first flight, the air pilot conveyed a pilot's watch to the Mayor of Birmingham. The machine completed the journey in 1 hour 45 min. in spite of a head wind, rain clouds, and belts of fog.

The Michelin Cup for Commercial Machines

For this year's competition for the Michelin Cup and the eighth (and last) of the series of prizes of 20,000 francs, a course of 3,000 kilometers round France has been mapped out, starting from and finishing at one of the aerodromes near Versailles (Buc, Villacoublay, Toussus, Châteaufort). The winner will be the pilot who, before January 1, 1922, covers the course at the highest speed practicable for commercial aviation. Stops will have to be made at the following points: Amiens, Châlons, Saint-Dizier, Gray, Joigny, Vienne, Nimes, Pau, St.-André-de-Cubzac, Romorantin, Angers, Evreux, Saint-Inglevert (8 kilometers from Calais) and Versailles (Buc, Villacoublay, Toussus, Châteaufort).

London-Copenhagen Air Service

An endeavor is being made to substantially improve the air service between Copenhagen and London, according to Mr. Willie Wulff, Manager of the Danish Aeronautic Company. Up to the present it has been necessary for passengers to stay overnight in Amsterdam, but by the new arrangements there will be two trips from Copenhagen and London daily. Aeroplanes with passengers will leave Copenhagen and London early in the morning, arriving the same night at London and Copenhagen respectively, and machines carrying mails will leave London and Copenhagen at night, so that the mail will be distributed the next afternoon in the two capitals.

Britain's Commercial Airships

The twin airships R-36 and R-37—the work respectively of Messrs. William Beardmore & Co., Ltd., and Messrs. Short Bros., Ltd.—which have been taken over by the Civil Aviation Department of the Air Ministry for the purpose of carrying out practical experiments with passenger airships, are reported to be nearing completion and are expected to be ready for an experimental flight early next month.

The R-36 will have accommodation for fifty passengers and the first flight, which probably will be of an official nature, is expected to provide valuable data for commercial companies who may eventually take over the direction of the passenger airships.

The airship will start for the Near East on its first flight and it is reported that the full complement of passengers will be carried, for whom sleeping berths and other comfortable provision are installed.

On a journey of 600 miles it is estimated that the ships could carry 17.43 tons, while on a journey of 16,000 miles the cargo-carrying capacity would be about 10.75 tons. Each of the new ships is fitted with four 350-horsepower engines. The normal rate of speed will be 62.8 miles an hour.

Possible Subsidies for Commercial Aviation in Britain

Recent reports from London indicate that there are distinct possibilities of commercial aviation in Britain receiving financial assistance from the Government. The Cabinet has had the subject under discussion and the hope is confidently expressed that the matter will receive their favorable consideration.

In June last the Advisory Committee on Civil Aviation recommended the subsidizing of air lines to the extent of £250,000 for two years, but, at that time, the principle of a subsidy met with strong opposition from influential quarters. Since then, several important companies have suspended operations and it is generally agreed now that steps must be taken, in some form or other, to sustain the industry through the present critical transition period.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Construction Details for a 29-Inch Flying Model of the Fokker Biplane

(*Continued from page* 521)

FOR a proper understanding of the following details it will be necessary to refer to the outline drawing of the German Fokker biplane published on the Elementary Aeronautics Page in last week's issue of AERIAL AGE. If the reader has redrawn at full size the outline given, the matter of detail will be more readily grasped.

It is well to proceed in an orderly manner, completing as much as possible of each group before attempt is made to assemble the whole. First the wings, then the body, the chassis, the tail and finally the struts. Then comes the finishing, such as covering and painting (which may be done before final assembly), and the power installation.

Remember to keep the weight low or difficulty may be encountered in getting the model to fly. While some slight departures from the specifications are allowable, radical differences may result in model of poor flying qualities. Good materials and careful workmanship go a long way toward satisfactory performance.

Wings

As the main planes or wings are rigid, they are built to require no external bracing except at the center; the N struts between the wings do not add much to the stiffness of the wings, but probably more evenly distribute the air loading on them.

For the upper wing, two tapered wing spars are needed. These are each 27¼" long with a section of 7/16"x1/16" for the front spar and 5/16"x1/16" for the rear spar. Mark the center of the spars and taper them from the middle to 3/16" high at the ends. In making the taper, cut the top side of the spars. This leaves the under sides of the wings flat.

Each rib will be different on the top side in so far as curvature is concerned. Use bamboo 1/32" thick and about 3/32" wide. Space ribs 1½" apart. Attach to spars with a few wraps of silk thread and hot glue.

Leading edges of ⅛" round reed. Trailing edges of fine steel wire. Stretch the wire tightly; when the covering is doped it will tend to curve the wire between each rib, giving the "scalloped" effect indicated on the drawing.

Where struts are to be located, glue small blocks on either side of the spar, and drill for the strut attachment. Aileron ends can be formed by means of heavier steel wire than that used for the trailing edges.

The lower wing spars are 22¾" long. Section, 5/16"x1/16" for front spar and ¼"x1/16" for the rear spar. At the middle, mark off a distance equal to the body width, 2⅜" (that is 1 3/16" to either side of center line) and begin the taper on the top side of the spar. Taper to ⅛" at tips. Follow same construction as for upper wing.

Struts for wing bracing may be of ⅛" round reed, slightly streamlined.

Body

Use ⅛" square spruce for the body members (longerons and struts). Bend them to form by steaming and allow them to become thoroughly dry before gluing and pinning the parts together. Drill all holes (No. 60 drill) for small nails to avoid splitting.

The front end may be covered with light gage aluminum, but silk or "bamboo paper," as for the wings and tail, will serve. The radiator can be made of balsa wood, painted to the appearance indicated, or it may be drawn upon cardboard and pasted to the body. The radiator should not be required to take any of the strain from the propeller mounting.

For the rubber strands, a spruce motor frame 3/16"x5/16" is required. At the rear, a steel hook is attached; at the front, a ball-bearing shaft or plain propeller shaft is secured. Cross members near the middle and at the rear of the radiator are made to hold the motor frame in place. Do not secure the hook end of the frame or a twisting of the body may result. It is a good rule to cover the hooks with small rubber tubing, or else wrap them with tightly-drawn flat elastic, to prevent the rubber strands from being cut.

Chassis

The pair of V members of the chassis are of ⅛" round reed. Wheels 2½" in diameter. Axle of 1/16" steel rod, 6⅝" long.

Chassis wing may be built up with ribs like the wings. Make sure it is kept flat on the under side during flight, for if it is tilted up or down, a drag will occur, causing the machine to nose over. No shock absorber is specified, but experienced builders should have but little trouble in devising fittings for that purpose.

The tail skid is in the form of a rigid stick fixed at the stern. If builders wish, the tail skid may be made shock-absorbing, but must be kept light in weight. Reed may be substituted if shock-absorbing qualities are desired, although this sacrifices the appearance somewhat.

Tail Surfaces

Simple outlines are recommended for the elevator-stabilizer and fin-rudder groups. The backbone of the fin, as well as the straight beams of the stabilizer, can be of spruce. Elsewhere ⅛" round reed is desirable. Silk thread binding can be used sparingly if hot glue is applied with care.

The stabilizer is braced from below by a pair of ⅛" reed struts from the body to the outer rib of tail plane.

General Instructions

Until good flight balance has been determined by actual test, the body should not be entirely covered in, but place should be left for shifting the lower wing location, as well as to provide access for varying the quantity of rubber strands.

A 9½" or 10" propeller may be used. Try about 14 strands of rubber to begin with and increase the number as may be required for adequate thrust.

Balance the model so that the weights fore and aft are equal at either side of a point 2½" from the leading edge of the top wing. This pre-supposes that wings are located in the same relation to one another as the drawing shows. As materials and methods of building differ, it may be found necessary to bring the wings slightly forward or a little backward from this position, but the adjustment should be gradual until finally located; they may then be fixed rigidly before full flights are attempted.

If, in gliding from the hand (with just a few winds of the propeller) there is a diving tendency, move the wings toward the propeller. If the machine climbs too quickly and then settles, it is "tail heavy" and the wings must be moved back a little until long, straight glides prove that correct balance has been attained.

More complete notes on the construction are not given, for it is desired to encourage individual ingenuity in solving the many minor problems that are bound to arise. It is believed, however, that sufficient explanation is given to enable the builder to produce a good-looking flying model as well as an interesting medium through which he will become more familiar with the design and construction of present-day successful aeroplanes.

Pasadena Elementary Aeronautics Club Formed

From Pasadena, California, comes notice to the effect that the first meeting of the Pasadena Elementary Aeronautics Club, held in the early part of January, indicated a bright future for the organization.

The P. E. A. Club was formed in connection with the Pasadena High School, which has a membership of over 2,000. A good deal of assistance in forming the club was rendered by Mr. Clifton, Professor of Physics, who is faculty adviser of the club.

Activities will begin with the building of simple models to teach the scientific principles of aeronautics, leading then to scale models, which will be thoroughly studied. Next will come the man-carrying glider, for, fortunately, the district has a wonderful choice of hills where experiments can be made. When gliding has been mastered it is possible that attention will be directed to the construction of a light low-powered aeroplane.

The program outlined above will give all the members a chance to become experienced in all the subjects mentioned. Interest will be stimulated by public contests, exhibitions and excursions to nearby aircraft factories and flying fields.

Young men residing in this section of California are invited to join this new club in the early stage of its development. Communications on the subject addressed to Mr. Hewitt Dix, Chairman, Pasadena Elementary Aeronautics Club, care Pasadena High School, Pasadena, California, will receive courteous attention.

Aeronitis is a pleasant, a decidedly infectious ailment, which makes its victims "flighty," mentally and physically. At times it has a pathologic, at times merely a psychologic foundation. It already has affected thousands; it will get the rest of the world in time. Its symptoms vary in each case and each victim has a different story to tell. When you finish this column YOU may be infected, and may have a story all of your own. If so, your contribution will be welcomed by your fellow AERONUTS. Initials of contributor will be printed when requested.

The Dawn Patrol

I awake from my slumber at 4 A. M.
By a noise that chills my heart.
The reason to you is hard to see,
For this dawn patrol is meant for me.
To meet the Hun at this early hour
Is not a thing that I desire.

Such a noise before I never heard.
Take a machine like that off the floor?
To run the bus on the ground is absurd,
Because the engine is doing 900 and not one rev. more.

One, two, three, four only I hear,
With a spit and a splutter, a clatter and a bang
They tear across the field and are gone
Without me, thank Heavens.
But with those engines. Oh, God, save them a kindly fate,
For this morning they will meet lots of hate.

What's that? Oh, Boy,
I arouse from my semi-conscious state
And realize that it was not a patrol of S. E.-5's,
But the bakerman's fivers taking their morning exercise.

SPEED.

Aviator Love

Aviator love's a wild, love, and aviator love's a glad,
And that is the love he gives to me—and the love that I give my lad
Is a keen love and a swift love, and a gay love and a blind.
Time enough for weeping and counting motives then
When the plane of my lad has fallen 'mid the fighting of the supermen.
It's the aviator love that he gives me—the desperate, reckless sort—
Which comes of knowing that death's aloft and may gather one in for sport.
Aviator love's a strange love, that only has today.
Lean, then, from the cockpit, and kiss and climb away
Amid the golden sunset, still soaring higher yet—
Aviator love's the only love that any lass may get.

FRANK J. ELLIOTT.

Although she really knew him well
She always called him Mr.
That is, she always did until
The second time he Kr.
And when she tried to learn to fly,
He really did ASr,
And then one day she went away,
My Goodness, how he Mr.!

The Housekeeper's Flight

I have left the life of the coddling moth,
For an airship flight to the sunny South;
In a light winged aero, skimming away,
To find the skies of a summer day.
Balmy and soft are the winds on my face,
Elated with joy I am leaving the place;
Farewell to the winter, farewell to the frost,
I am off in the aero, to the world I am lost.
"Whither, O whither, Old Woman so high?"
I hear a voice from the old world cry.
Good-bye to the duster and flaxen broom,
There will be no cobwebs to sweep from the moon;
In a golden chariot she beckons me on,
To sit a while with her, till evening is gone.
But I must not tarry or all will be lost;
On this light-winging aero I am skimming and tossed
Like a bird of the air, like a stork in the sky;
I'll surely be with you again by and by.
Oh, must I return to a weary, worn earth!
I fain would fly higher, where song hath it's birth;
Where shadows ne'er fall, and joys never die,
I am back to the earth, but I long for the sky.

—"BARDICK."

Millstone Hill, Barre, Vermont.

Aces Up

Major—When the royalty of Belgium flew to England, who took the King and Queen?

Captain—I imagine it was an Ace.

—*J. H. M.*

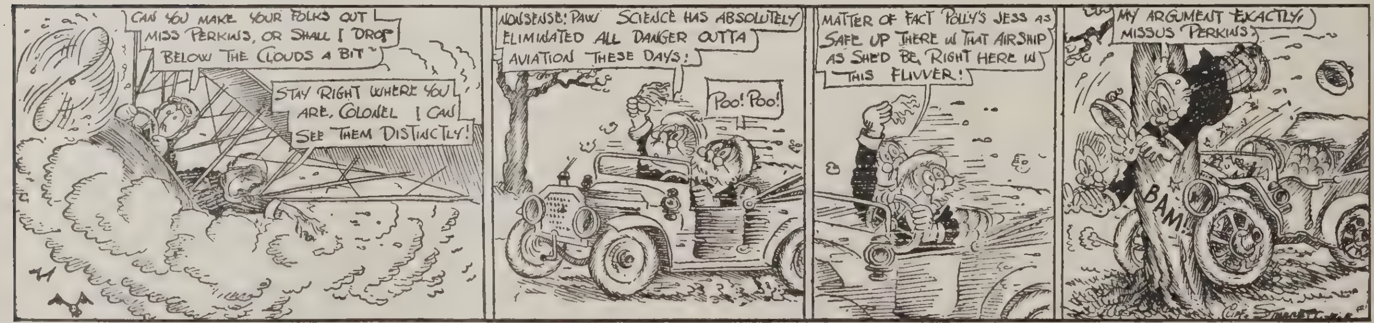
Advice to Pilots

Fly from drink, you fly from care,
Shun tobacco, never swear—
Keep smiling.

Kissing a woman is like taking olives out of a bottle—get the first one and the rest come easy.

Well, Isn't It?

Me and Bill went
Down to the picture show.
The orchestra played
"Over There," and Bill
Thought it was the national anthem
And stood up.
So did I.
Darn Bill.


CAN YOU MAKE YOUR FOLKS OUT MISS PERKINS, OR SHALL I DROP BELOW THE CLOUDS A BIT?
STAY RIGHT WHERE YOU ARE, COLONEL I CAN SEE THEM DISTINCTLY!
NONSENSE! PAW SCIENCE HAS ABSOLUTELY ELIMINATED ALL DANGER OUTTA AVIATION THESE DAYS!
Poo! Poo!
MATTER OF FACT POLLY'S JESS AS SAFE UP THERE IN THAT AIRSHIP AS SHE'D BE, RIGHT HERE IN THIS FLIVVER!
MY ARGUMENT EXACTLY, MISSUS PERKINS
BAM!

Courtesy N. Y. Evening Journal

The American ace aviator goggle, unlike all others, affords safety and widest vision through its unshatterable optically perfect lenses in the form of a meniscus. Price $10.00.

GEO. S. JOHNSTON COMPANY
5 South Wabash Ave. Chicago, Illinois

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"Aerial Age Weekly has a circulation which covers the whole of the aeronautic world."

AERONAUTIC INSTRUMENTS

(*Continued from page* 539)

Among the erecting mechanisms which have been devised mention should first be made of that of Dr. J. G. Gray, which has achieved very considerable success. The essential feature is a revolving disc having specially curved slots in which roll a number of steel balls, the whole being rigidly attached to the gyro frame, and the disc being slowly rotated by either an electric motor or air turbine. The plane of the disc is ordinarily normal to the direction of gravity, in which condition the balls are symmetrically arranged around the axis of rotation. If the gyro and the disc are displaced out of this symmetrical position the balls roll, and, due to the combined action of the rotation of the disc and the curvature of the slots, the displacement of the balls is such as to give a couple in a plane at right angles to the plane in which the gyro axis has been moved, which tends to erect the gyro. Of course, the erector also tends to move the gyro axis out of the true vertical into the apparent vertical. The magnitude of this couple and hence the rapidity with which the disturbed gyro is restored to the vertical may be increased by increasing the speed of the disc. This very ingenious device has been further developed than any other, and shown to be practicable and reliable, but there does not seem to be any easy way to limit the range through which the erector acts.

A second scheme has been worked out by the Sperry Company and Doctor Lucian, of the Air Service. This involves two short-period pendula, swinging around the gimbal axis of the gyro in the fore- and aft and transverse planes, each carrying a roller contact which plays over a two-part metal contact arc. In the symmetrical position, when apparent gravity is parallel to the gyro axis, neither roller makes contact with either half of its arc, but if the gyro is displaced in either plane a contact is made which actuates an electromagnet in such a way as to introduce a torque at right angles to the plane of displacement, which tends to erect the gyro.

A third form, which was extended and improved by the Air Service, originated, I think, with one of the early forms of the gyroscopic compass. This again involves two short-period pendula each of which, in the symmetrical position, covers two small air outlets. When displaced, one or the other of these is opened and the reaction of the escaping air-jet is in the plane perpendicular to the displacement and in such a direction as to erect the gyro.

Such gyroscopic devices as we have been describing are of fundamental importance as auxiliaries attached to bomb-sights, cameras, artificial horizons, ground-speed indicators and other apparatus which it is desired to maintain as nearly as possible in a fixed relation to the true vertical. Attached to a double pivot symmetrical compass, they would eliminate the turning errors of that instrument, but at the cost of undue complication; attached to a bomb-sight they would eliminate the largest errors of bomb-dropping, as was about to be practically demonstrated on a large scale just at the close of the war. They also contribute an essential element to the successful application of aerial photography to accurate topographic mapping. It is difficult to state the acuracy with which they will operate, as this depends entirely upon the conditions of use, but it is safe to say that in a carefully piloted plane the best of them would certainly maintain the true vertical to 1° or less.

There remains to be considered only one class of instrument, all of which are still in the stage of a dream rather than a realization, that is, absolute position indicators which would indicate at any time, without any outside observations, the absolute position (latitude and longitude) of a plane. So far as known, experimenters and suggestions have been along the following lines:

1. The use of the direction of total magnetic force.

2. The gyroscopic maintenance of a fixed direction, compensated for the earth's rotation.

3. The double integration of acceleration to give velocity and then distance travelled (really automatic dead reckoning).

All of these would involve, among other things, a satisfactory stabilizing device, but the additional difficulties are so great that they have so far proved insurmountable. I feel that this problem of a position indicator is a sufficiently difficult one to leave to the readers and is worthy their best efforts.

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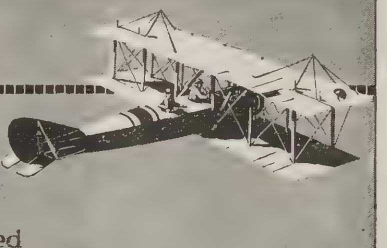

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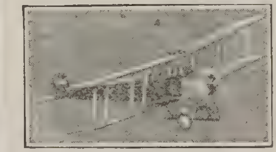

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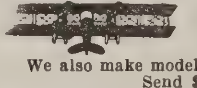

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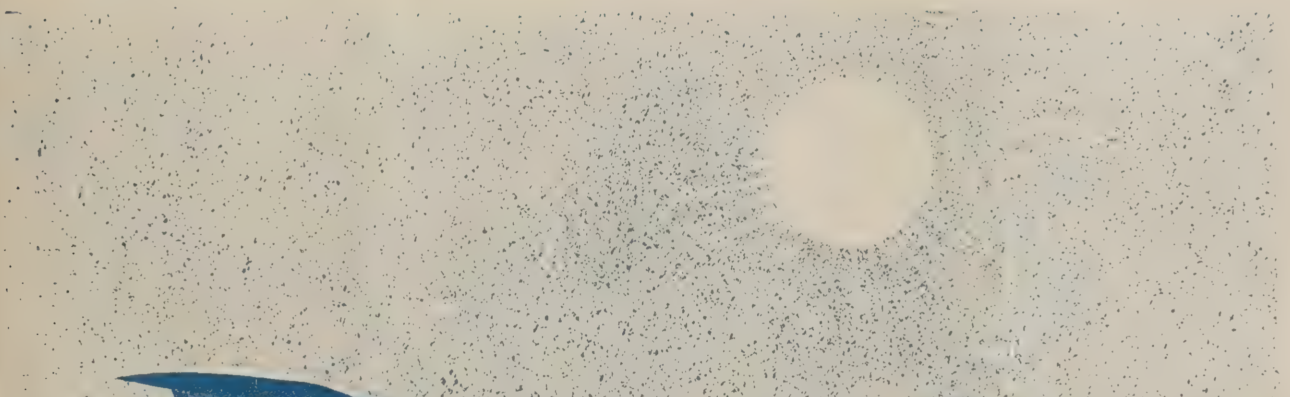

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AERIAL MAIL RECOMMENDATION ENDORSED BY PRESIDENT WILSON

THE Executive Committee of the National Advisory Committee for Aeronautics met on January 13 and submitted to Congress, through President Wilson, a report on the present aerial mail situation. In transmitting it to Congress, the President wrote:

"I transmit herewith for the consideration of the Congress a special report of the National Advisory Committee for Aeronautics, in which the committee sets forth its views as to the value to the Nation of the Air Mail Service of the Post Office Department based on broad, general considerations of national interest and policy.

"I concur in the opinions expressed by the National Advisory Committee for Aeronautics, and endorse its recommendation for the continuance of the Air Mail Service."

The report of the National Advisory Committee follows:

To the CONGRESS:

The executive committee of the National Advisory Committee for Aeronautics, at a meeting held on January 13, 1921, had under consideration the present status of the Air Mail Service of the Post Office Department and the probable effect on the development of aeronautics in America of the discontinuance of this activity, which has been threatened by the elimination on the floor of the House of the appropriation for its continuance.

It is the opinion of the National Advisory Committee for Aeronautics that the Air Mail Service is in effect an experimental laboratory for the development of the civil uses of aircraft, and, viewed from this angle alone, is worth what it costs over and above the value of the service it actually renders in the more rapid transportation of mail.

The Sixth Annual Report of the National Advisory Committee for Aeronautics contained a statement of a national aviation policy, in which the need of Federal encouragement for the development of commercial aeronautics was emphasized and the definite recommendation made that the Air Mail Service of the Post Office Department be further extended and developed.

The increasing relative importance of aircraft in warfare not only justifies, but makes imperative the expenditure of public funds to aid the development of commercial aeronautics, on which military and naval aeronautics will be largely dependent. The Air Mail Service has given the best demonstration of the practicability of the use of aircraft for civil purposes, and, in the face of many obstacles, has accomplished remarkable results of real and permanent value to the Nation at relatively slight cost. It is the unanimous opinion of the National Advisory Committee for Aeronautics that the Air Mail Service of the Post Office Department should be continued.

The reasons for this special report are set forth in the following resolution, which was adopted without a dissenting vote on January 13, 1921:

Whereas the Air Mail Service of the Post Office Department has given to the world the best demonstration of the practicability of the uses of aircraft for civil and commercial purposes, and has greatly promoted the commercial development of aircraft; and

Whereas the development of the civil and commercial uses of aircraft is essential to the maintenance of an aircraft industry in such a condition as to permit the necessary expansion in time of war, unless the taxpayers of the country are willing to pay, through Army and Navy expenditures, practically the entire cost of maintaining the industry; and

Whereas the civil development of aviation will aid military development and will in time bring about the establishment of air routes and landing fields more or less generally throughout the United States, which will be an important military asset in time of war; and

Whereas the Air Mail Service has already contributed to the progress of civilization by improving the means of business communication and transportation; and

Whereas the Army and Navy Air Services are by law limited to the development of types of aircraft for military and naval purposes which do not satisfactorily meet commercial needs; and

Whereas the needs of other civil agencies of the Government, such as the Forest Service, the Coast Guard Service, the Coast and Geodetic Survey, require the development of nonmilitary types of aircraft; and

Whereas the operation of the Air Mail Service is at the present time an essential part of the organized plan for the development of commercial aviation as contained in the national aviation policy formulated by this committee, and the cost of fostering such an organized plan is much less than the waste that would inevitably result from unprepared entry into war; and

Whereas several European countries are supporting the development of commercial aviation, the discontinuance of the Air Mail Service will be a backward step in the development of aviation and will retard for a number of years the establishment of landing fields generally: Therefore, be it

Resolved, That it is the opinion of the National Advisory Committee for Aeronautics that the Air Mail Service is in effect an experimental laboratory for the development of the civil uses of aircraft, and that, viewed from this angle alone, it is worth what it costs over and above the value of the service it actually renders in the more rapid transportation of mail;

Resolved further, That the National Advisory Committee for Aeronautics submit a special report to the Congress through the President, stating that in its opinion the increasing relative importance of aircraft in warfare and the need for adopting and carrying through a sane, sound policy for the development of civil aviation, such as is outlined in the statement of a national aviation policy contained in the Sixth Annual Report of the National Advisory Committee for Aeronautics, not only justifies but makes imperative the expenditure of public funds to aid the development of commercial aeronautics; and that, as an existing agency which has, in the face of many obstacles, accomplished remarkable results of real and permanent value to the Nation, and at relatively slight cost, the Air Mail Service of the Post Office Department should be continued.

Respectfully submitted.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS,
JOSEPH S. AMES, *Chairman Executive Committee.*

British Cabinet Approves Subsidy for Civil Aviation

THE British Government at last has followed the policy of the French and German Governments and has taken a step toward the development of civil aviation. This is indicated by an announcement from the Air Ministry of a grant of $300,000 a year for direct assistance to companies engaging in air traffic. The advisory committee suggested twice that amount, but while the grant is small it is looked upon as a step in the right direction and one which will serve as an inspiration for progress.

The money is available for companies operating over approved air routes on a basis of 25 per cent. of the total revenue earned by carrying passengers, mails and goods. The grant becomes effective from 1st January, 1921. A company in order to obtain the benefit of the grant must show that it has developed business and flying time equal to a certain minimum which will be stipulated under the rules of the grant, and it must use aircraft of British manufacture fitted with British made engines.

Following is the Air Ministry announcement on the subject:

"During the financial year 1921-22 payments under this grant will be limited to a maximum sum of £60,000 and will be made to British companies operating on approved aerial routes. They will be calculated, subject to the above limitation in regard to the total sum available, within the year, on the basis of twenty-five per cent of the total ascertained gross revenue of each company (exclusive of the Government grant) earned by the carriage of passengers, mails and/or goods, on and after 1st January, 1921.

"No differentiation will be made with regard to the class of load carried and payments will be allotted on the return for each period of three months treated separately, provided that the company can show that on a minimum of 45 days in each period of three months (or such other factor of regularity as may be determined later by the Air Council) flights have been completed in both directions by aircraft of British manufacture fitted with British made engines within a fixed maximum period of time allowed for each journey.

"The routes at present approved are London to Paris, London to Brussels, and London to Amsterdam.

"Extensions to these routes and additional routes, such as England-Scandinavia, on which the possibilities of a service employing flying boats or amphibian machines, or a mixed service of sea and land aircraft, can be demonstrated, may be approved from time to time if satisfactory proposals are received by the Air Council.

"The maximum time allowed for journeys between London and Paris, between London and Brussels, and between London and Amsterdam will be four hours from aerodrome to aerodrome (or such other time limit as may be determined later by the Air Council).

"Payment of the grant will be subject to the production for departmental inspection, when required, of such accounts and records as the Air Council may deem necessary.

"Any British company intending to run on the routes and notifying the Air Council of this intention will become an "approved" organization by fulfilling the conditions laid down."

THE NEWS OF THE WEEK

Daniels Investigates Possibilities of Aircraft and Improved Submarines

Washington.—The Navy General Board has been instructed by Secretary Daniels to institute an investigation into the probable design of "the type of ship that will form the main strength of the navies of the world of the future" and particularly into the possibility of aircraft and improved submarines displacing capital surface vessels, it was learned recently. The board's orders are to conclude the investigation in time to report early in February.

Plan New Mail Service

The establishment of an air mail service between Houston and Tampico, Mexico, is virtually assured in a cablegram received at the Chamber of Commerce, Houston, from the manager of the foreign trades department, who is now in Mexico attending the inauguration of President Obregon.

Loops Seagull

David H. McCulloch, of N.C.-3 fame, astonished a large crowd at Palm Beach recently when he looped a Curtiss Seagull. It is understood that this is the first time the feat has been accomplished. McCulloch is now chief pilot at the Palm Beach station of the American Trans Oceanic Company.

Arkansas City Has Aerial Derby

In order to arouse interest in commercial aviation the Chamber of Commerce of Arkansas City, assisted by the Williams-Hill Airplane Company, organized and carried through an aerial derby of considerable importance last month.

The directors of the Chamber of Commerce are to be congratulated on the extraordinary enthusiasm which they stirred up locally concerning the event and the success with which each item on the program was carried through.

The local business men presented a series of seven cups for competition and all of the gasoline and oil used during the events was supplied free of charge by local companies, and the contesting aviators were the guests of the Chamber of Commerce during their stay in Arkansas City.

The winners of the various events were as follows, according to the judges, who were Oliver Fuller, R. W. Oldroyd, and Lieutenant Lynd; and Foss Farrar, who was the official timekeeper.

Thirty-mile derby to Winfield and return, Lieutenant Johnson. Time 10 min., 39⅕ sec.

Landing for mark, Lieutenant Beverly. The first try at this event was a tie between Beverly and Lucus, and in the second trial Beverly was announced the winner.

Fifteen-mile derby to Chilocco and return, C. J. Lucus. Time, 12 min., 20 sec.

Loop the loop from a height of 2,500 feet, down to 1,000 feet, Lieutenant Mills in the German Fokker. He looped twelve times in that distance.

Altitude climb of two minutes for government planes, Lieutenant Johnson, who climbed 2,500 feet.

Altitude climb for commercial plane, Dick Phillips.

Three landings and take-offs, Lieutenant Beverly.

Chinese Representative Visits March Field

Dr. Hau Un Yuen, of Peking, China, was a visitor at March Field recently. Dr. Yuen is a financial agent for the Chinese government and has been negotiating with officials of the Morgan interests of New York. He is en route home, and while at March Field evidenced marked interest in the various types of planes used at this school. He was accompanied by his nephew. Mr. Shen, of Shanghai. China.

Honeymoon Plane is Seized by U. S. Customs

Buffalo.—When Flight Lieut. J. C. Hamilton of Toronto, recently of the Royal Canadian Air Force, decided to take his wife of a few days on a honeymoon through the clouds, he picked out a peck of trouble for himself. En route from Toronto to Nashville, Tenn., two days ago, he pulled himself out of a nose dive near Hamilton, Ont., just in time to save his privately-owned aeroplane and incidentally the lives of himself and of his bride.

Yesterday, buffeted about by treacherous winds over the Upper Niagara River, he was forced to land in the big field south of the city. In landing, a strut of the aeroplane was snapped and one of the wheels was smashed.

Today the big flyer rests in the mud. Around its steering wheel is a padlocked chain, sealed by United States Custom officers, and pinned in the cockpit is a note instructing the owner to report himself immediately to the Collector of Customs of the Port of Buffalo. Just what action authorities propose to take has not been determined.

No one seems to know the whereabouts of Lieutenant Hamilton. Accompanied by his bride he left his aeroplane and supposedly came to Buffalo.

Detroit Club Election

Lew W. Kunze was elected president of the Air Service Club of Detroit at a meeting in the Army and Navy Clubhouse, Jefferson avenue and Rivard street, recently. George H. Stimson was chosen vice-president, and George W. Wooley, secretary and treasurer. The executive board for the ensuing year will be: R. B. Fish, J. Gordon Rankin, George Wilcox and Henry M. Lamb.

Proposed Gift of Land for Air Station Meets With Opposition

The Commissioners of the Sinking Fund held a hearing on the proposal to cede to the United States ninety-seven acres of the Jacob A. Riis Park at Rockaway Beach, the land to be the site for an aviation station. The Legislature has passed an enabling act authorizing the city to give the land, which cost $836,837, if the city officials advise it.

Rear-Admiral J. H. Glennon argued for the gift. He laid stress on the protection an air station would give the city, adding that if the land were not given to the department he thought the station would be transferred to another point on the coast. Raymond V. Ingersoll, Secretary of the City Club and former Park Commissioner of Kings County, opposed the gift.

"We would like to find out from the Navy Department its real requirements," said Mr. Ingersoll. "The land applied for is on the Jamaica Bay side of the Jacob Riis Park and it will affect the recreation of the whole city. The beaches are getting more and more crowded and the beach in this section will be needed."

Leonard M. Wallstein, for the Citizens' Union, the Brooklyn Chamber of Commerce and the Real Estate Board of New York, also opposed the grant.

Admiral Glennon, replying to the opposition, pointed out that if the land were not used as an air station it would revert to the city. He said that it would cost the Government $300,000 to build a breakwater to protect its property.

Others whose remarks indicated partiality to the scheme, remarked that it would be cheaper for the city to grant the application of transfer than to build the breakwater.

The hearing was adjourned to February 17th in order to give the civic organizations time to examine their opposition more thoroughly and to give the Chief Engineer of the city an opportunity to determine the progress of erosion of the land.

Flying Club of Virginia

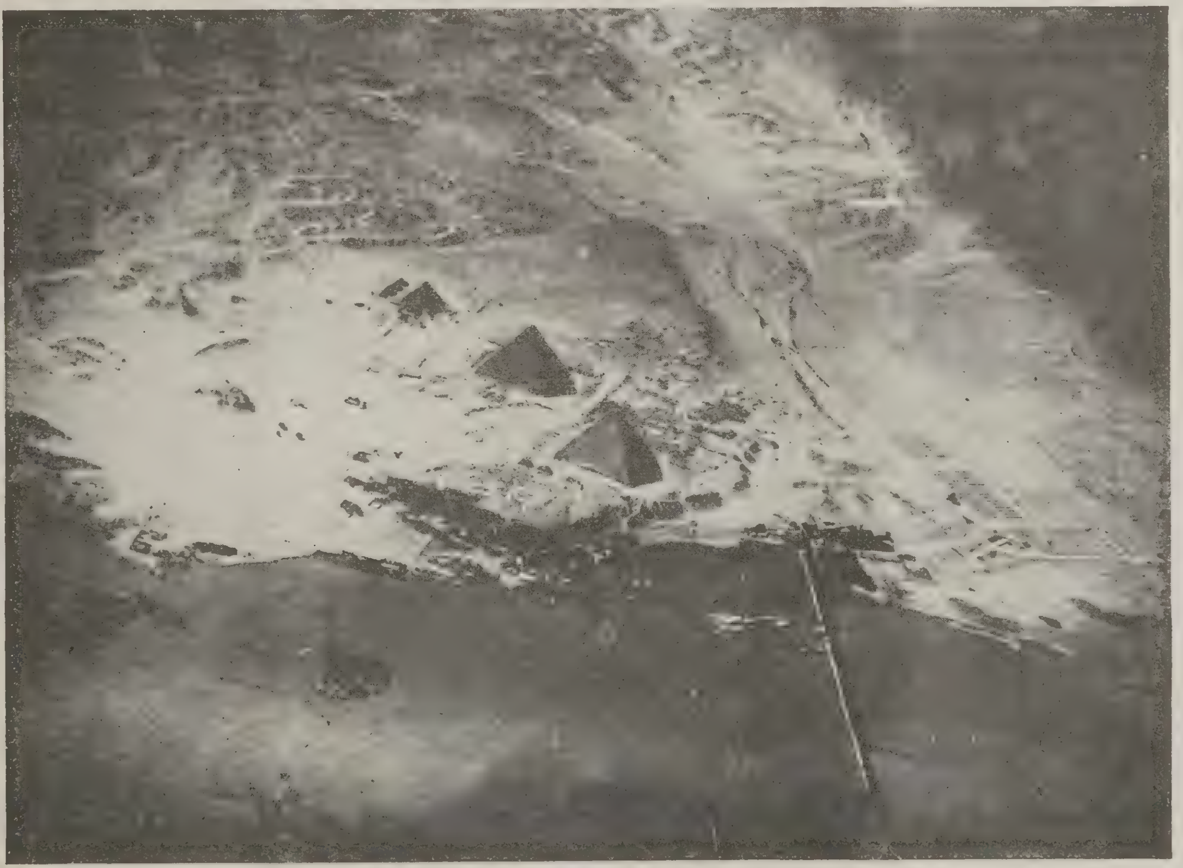
The second annual supper of the American Flying Club of Virginia was given at the Westmoreland Club, Richmond, on December 30. Following compose the Board of Governors: A. Woolner Calish, Ewan Don Cameron, John B. Cary, A. Randall Hagner, S. Littlepage Ingram, Douglas Lancaster, Waverly Melton, James Patton, Chas. B. Robertson, Jr., Allan W. Valentine, and John W. Williams, Jr. The officers are: Ewan Don Cameron, President; John B. Cary, First Vice-President; Chas. B. Robertson, Jr., Second Vice-President; S. Littlepage Ingram, Secretary; Allan W. Valentine, Treasurer; Allen G. Collins, Counsel-to-the-Officers. The committee chairmen are: Aviation Activity, A. Randall Hagner; Membership, Chas. B. Robertson, Jr., and Publicity, J. M. Cecil.

Valparaiso Has School of Aviation

A sum of $565,000 has been raised by a committee. aided by a government grant, for the purpose of founding a civil school of aviation in Valparaiso, South America. The aerodrome is to be complete, with hangars and workshops. Suitable ground to the extent of 1,250,000 square meters has been secured, and part of it will be laid out for football matches and other outdoor sports

Maryland Aviation Commission

Governor Ritchie has appointed the following to the Maryland State Aviation Commission: Dr. Joseph S. Ames, W. Frank Robert, Temple N. Joyce, Garland W. Powell, William D. Tipton and J. Fletcher Rolph.



Aerial photograph of the ancient Pyramids, showing the famous highway to Cairo

The AIRCRAFT TRADE REVIEW

Flying Boats Procurable on Easy Payment Plan

The United States Navy has arranged with the Aeromarine Engineering and Sales Co., New York, to sell for commercial use more than 100 of the six-place H.S.-2 Navy Coast Patrol Flying Boats. By this arrangement an aviator buying one of the machines does not necessarily have to pay spot cash for it, but can purchase it on the installment plan. This should have far-reaching results, mainly encouraging civilian flying, and thereby facilitating the training of an aeronautical reserve. In a telegram to C. F. Redden, President of the Aeromarine Engineering and Sales Co., Secretary of the Navy Josephus Daniels explained the Government's action as follows:

"To promote the National Defense, and in the belief that the country will be benefited by the development of commercial aviation, and to encourage civil aviation for business purposes, the Navy Department offers for sale a limited number of H.S.-2 Navy Coast Patrol Flying Boats, the most successful type developed under rigid Government tests."

As stated above, the Aeromarine Engineering and Sales Co. is handling these sales. Instead of selling the flying boats for $18,480, the price at which they are valued, the Government has allowed their sale at $6,160 each. This is a rare opportunity when it is considered that they are particularly adapted to passenger carrying, aerial photography, forest patrol, timber scouting, surveying and mapping, etc.

Continuance of Air Mail Recommended

Washington.—Continuance of the transcontinental aeroplane mail service was recommended by the Senate Post Office Committee recently in reporting the annual Post Office Appropriation Bill.

The committee inserted an appropriation of $1,500,000 for this service. When the bill was before the House the appropriation was stricken out on a point of order.

As reported by the committee, the Post Office Bill carries $574,307,552, an increase of $1,592,831 over the House total.

Company Forming for Mail Route

Birmingham, Ala.—Organization of a company for the puprose of operating locally the air mail route between Chicago and Birmingham has been effected with Walter Caldwell as chairman. Mr. Caldwell is now in Washington conferring with the assistant postmaster general with regard to the project, and announcement of an early inauguration of the service is expected momentarily. According to those identified with the movement, $100,000 worth of stock has been subscribed and the company awaits only the approval of the government to begin operating the new mail service.

Honduras Gets Planes

Two American aviators have arrived in Honduras with American built machines, bought for the War Department. They are engaged for a certain period to teach flying and how to care for the aeroplanes. It is expected that the machines will be used for the transportation of mail over the country, where railroads are very scarce and roads very bad.

Metric Standards Bill in Congress

A Bill which will establish the metric system of weights and measures in the United States is now prominently before Congress. This Metric Standards Bill recently was introduced in the Senate by Hon. J. S. Frelinghuysen of New Jersey and in the House of Representatives by Hon. Fred A. Britten of Illinois.

Nationwide support has been pledged the proposed legislation. More than 100,000 petitions asking for favorable Congressional action are now on file with the Department of Commerce, Washington, D. C.

Advocates of the decimal advance point out that the Metric Standards Bill is most liberal in its provisions, allowing 10 years for the transition period. Manufacturers may use whatever measures they desire in production, but commercial transactions are to be on the decimal basis, already employed to such advantage in United States coinage. Adoption of the metric standards, it is declared, will greatly aid both internal and world trade, education, engineering and industry.

The Future of the Zeppelin Company

Since the visit to America last summer of representatives of the Zeppelin interests, there have appeared from time to time in the public press many contradictory reports as to the future plans of this company. Apropos of this, an item which appeared in the German *Flug-Welt* of November 24, 1920, will be of interest.

According to this report, certain commercial steps were discussed and negotiations initiated with regard to the delivery of a ship. However, no contract was made and nothing conclusive resulted from these preliminaries. In point of fact, according to *Flug-Welt,* the Zeppelin plant is still inoperative by reason of treaty regulations, and the use of the company's commercial ships has also been forbidden awaiting certain discussions of the Air Commission. Meanwhile, of course, the company is cut off from international competition.

"The transfer of the Zeppelin plant to the United States is clearly impossible," says *Flug-Welt;* "it is, however, not impossible that a branch may be started in that country in the future."

Miss Aloysa McLintic and Earl Daugherty, who is instructing her in the art. Miss McLintic will use her own machine for pleasure next summer

Forthcoming Exhibitions

The forthcoming international exhibitions are of interest to American aircraft manufacturers desirous of cultivating foreign markets:

Delhi, Motor Vehicles and Accessories Exhibition, February 7, 1921.

Lyons, Fair (metallurgy, engineering), March 1-15, 1921.

Frankfort, International Exhibition, April 10-16, 1921.

Algiers, Fair, international exhibition of motor vehicles.

Barcelona, Automobile exhibition, international, May 2-12, 1921.

Lima (Peru), International Industrial Exhibition, June-October, 1921.

Bale, Motor Vehicle Exhibition, international, June 18-July 3, 1921.

Buenos Aires, International Exhibition, all industries, 1922.

Rio de Janeiro, Centenary Exhibition, international, Autumn, 1922.

Diggins Enlarges Scope

The Ralph G. Diggins School of Flight and Commercial Aviation Company has just increased its capitalization to $30,000 in order to enlarge and carry on commercial aviation on a greater and more pretentious scale this season.

Among the most important changes and additions being made at the Diggins aerodrome in Chicago are the installation of a large wireless station for telegraph and telephone; the building of living quarters for their students at the field. These quarters will be large, airy sleeping rooms with comfortable beds, a good dining-room, shower baths, library, and everything to make the life of the student comfortable.

Several new courses have been added to their course of instructions. They are now offering a complete ground mechanics' course, consisting of motor instruction, assembly, dissembly, carburetion, ignition, overhauling, etc. The plane work consists of assembly and dissembly, repairing, covering, wood, metal, wire working, materials, etc., a thorough course in aerial navigation, instruments, field management and general instruction.

Lectures and classroom work will be carried on during the middle of the day, while the flying instruction will be carried on in the early morning and late afternoon. Curtiss and Avro machines are used for instruction, while work is given in three types of motors, the vertical, the V-type and the rotary.

During the past season this school graduated thirty-one pilots.

THE LEITNER-WATTS ALL-METAL PROPELLER

ALL-METAL propellers made by the Metal Airscrew Co., Ltd., have been thoroughly tested, in a tensile testing machine, by "spinning" at Farnborough, and in actual use on a Bristol seaplane. It may be stated, that broadly speaking, all but one of the problems of the metal propeller have been solved. This one is that of weight. In their present form these propellers are certainly very considerably heavier than the corresponding wooden screws, but this is a drawback which the designers are confident of being able to remedy.

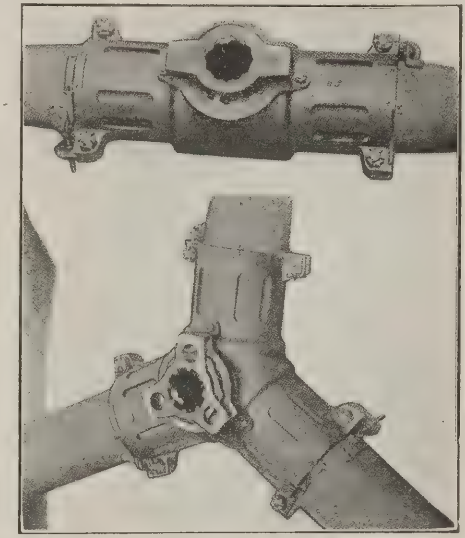
General Features

Briefly speaking, what the designers of the Leitner-Watts metal propellers have done is as follows: Dr. Watts, who is, of course, one of the front rank British propeller experts, has designed what may be termed a series of good all-round blades. Mr. Leitner and his staff, on the other hand, have translated these designs into metal construction, and have designed for them metal hubs into which fit two, three or four of these blades. In this way, out of a relatively small number of standardized parts, one can make up a large variety of propellers to suit different conditions.

Blade Construction

To deal with the propeller blades first. There are, of course, an almost infinite number of ways in which the construction of metal blades can be carried out. A series of experiments extending over several years have led to the adoption of the construction shown in the accompanying illustrations. Each blade is made up in the form of a shell of sheet steel, and the necessary taper in thickness is obtained by using laminated construction. There are in all three laminations, one at the top, two about halfway between tip and boss, and three at the root. The shape of the laminations will be seen from the illustrations. The outer shell runs right through, the second or middle lamination is forked at its outer end and extends inwards to the hub, the third and inner lamination extending from the hub and about halfway along the middle one. The three laminations are at present riveted together, but later on it is intended to employ electric spot welding instead of the rivets. This laminated construction has two advantages: it provides a means of proportioning, approximately, the blade strength to the stresses at any point, and it prevents vibrations being set up, as each lamination has its own particular period which does not tally with that of the other two.

The two halves of each blade are attached to one another, at the edges only, by welding, but in order to stiffen the shell thus formed small struts are placed between the two faces at intervals. The manner of getting these struts into place is rather ingenious, and is illustrated in one of our sketches. The struts are shouldered at both ends, and the hole in one face of the blade is just the right size to take the thin portion of the strut. In the other face of the blade is cut a hole large enough to accommodate the thick portion of the strut. From this hole runs a slot of a width corresponding to the shouldered portion of the strut. To place in position, the strut is inserted through the large hole, its other end being pushed into the small hole on the opposite face, and the shouldered portion is slid into the slot. The strut is then secured in position by soldering washers over the two strut ends. Originally these washers were welded on, but the joint so made was not as neat as might be desired, and now soldering is employed, this having been found strong enough for the purpose.


The Leitner-Watts principle as applied to two and three-bladed propellers

The Very Substantial Blade Root

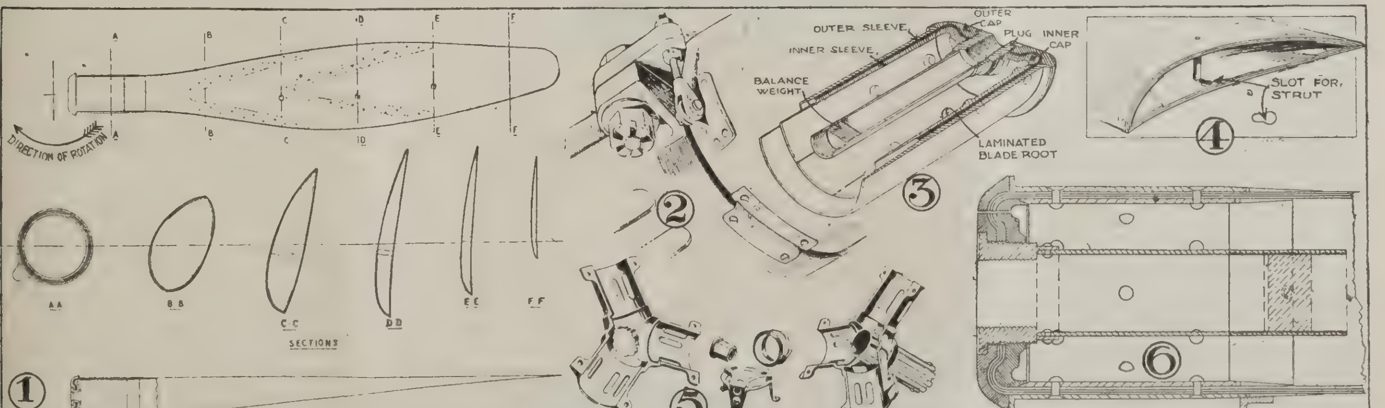
The root of the blades is so constructed that it is impossible, under stresses arising in ordinary use, for the blade to be torn out of the central hub. The section and sketch of a sectioned blade root published herewith should make the details of the construction clear. The inner end of the blade is finished with serrated edges, as shown in the photograph of a half-blade. An inner sleeve is pushed into the hollow blade root, and on the inner end of this sleeve is placed a steel cap, the serrations of the blade projecting beyond this cap. The serrations are then bent over the rounded top of the inner cap, and the outer sleeve and cap placed in position, being locked in place by the central plug. Rivets passing through blade and sleeves further prevent the blade from pulling out, although the bent-over serrations probably relieve the rivets of practically all the shear stress. In addition to these precautions the sleeves are tinned before being placed in position, as are also the serrations, the whole being heated and soldered afterwards. In order to ensure free air circulation, and also to prevent excessive pressures when the machine rises to a great height, there are vent-holes both in the tip and root of the propeller blades.

Balance

In spite of every precaution in making up the blades, it is, of course, impossible to get them all of exactly the same weight or distribution of weight. In order to ensure perfect balance in running, small balance weights are used, which can also be seen on the sectional drawings. These weights are carried on short lengths of tube secured to the inner end of the central plug in the blade root. They are tinned before insertion in the tube, and when the right position for them has been found they are soldered and pinned in place. This balancing up is carefully done at the works, and if a user requires a single new blade he is ensured that the replacement will be correctly balanced when he gets it, and he therefore need not trouble about the balance of the new blade being right.

The Hub

The hub which holds the blade together is, in the earlier models, a split phosphor-bronze casting, shaped so as to house between its two halves, and gripping it tightly, the blade root. In addition to the friction the blade is held in position as regards centrifugal stresses by the shoulder on the blade root bearing against the recess of the boss. The latter is held to the engine-shaft via a splined bush, shown in the

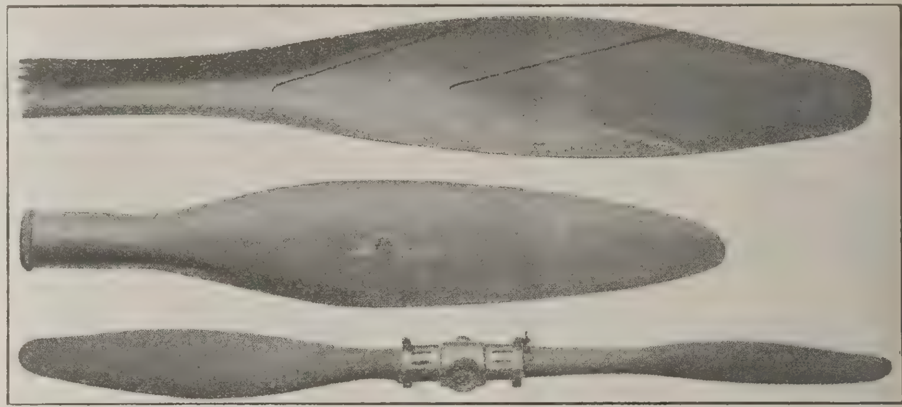


1. General arrangement and sections of the Leitner-Watts metal propeller blade. 2. Method of adjusting the pitch of the propeller. 3. Section of the blade root. 4. Method of inserting small struts between front and rear faces of the propeller. 5. The split hub of a three-bladed propeller; note the splined bush which transmits the drive to the hub. 6. Section view of the root of a blade, showing inner and outer sleeves, caps, plug, etc.

sketch of the hub for a three-bladed propeller. This splined bush is standard as regards outside shape and dimensions, fitting all the different types of propellers, but internally it is finished to fit any particular engine. The method of locking it in place is shown in the sketch, and also in the photograph of the three-blade hub. In the latest type the hub is a steel drop forging, which makes a rather neater job.

Adjustment of Pitch

The Leitner-Watts metal propellers have adjustable, although not as yet variable, pitch. That is to say, the pitch angle of the blades can be altered over a wide range —10 degrees each way—thus making a propeller suitable for a number of different conditions by setting the pitch according to requirements. For the purpose of adjusting the pitch vernier scales are placed on the blades and boss, the adjustment being made by means of a simple eyebolt as shown in our sketch. In this way very fine adjustment can be obtained, the vernier giving the angle and the turning of the locknuts on the eyebolt making the adjustment. It will, of course, be understood that before adjusting the angle of the blade the large bolts securing the two halves of the split hub are slackened, thus allowing the blade to rotate freely in the hub.



The upper illustration shows the inside of a blade. Note the serrated edges of the root, which are tucked in between two sleeves and thus hold the blade against centrifugal stresses. The illustration in the center shows a finished blade and the lower shows the finished two-bladed propeller

THE LACHMANN AEROFOIL

According to an article which appears in a recent issue of *Flugsport,* it would seem that the German engineer, G. Lachmann, made application for a patent in February, 1918, covering an aerofoil design apparently very similar to the Handley Page wing which has already been described in Aerial Age. Following is a translation of the article in *Flugsport:*

"We learn that already in February, 1918, the same idea (as the H. P. wing) was placed before the Patent Office by Herr Otto Kattler on behalf of the inventor, Herr G. Lachmann, of Darmstadt. The specification is as follows: 'Aerofoils whose profile consists of several separate staggered elements, arranged in the form of a Venetian blind.' The claim was founded on the following considerations: 'The lift of a curved plane moving through some medium is composed of a positive pressure on the lower surface and a negative pressure on the upper surface of the plane. The present invention has for its object an increase in the lift of an aerofoil. To achieve this the thick aerofoil F is divided into auxiliary sections f_1, f_2, f_3, Fig. 1.'

" 'The spaces between the auxiliary aerofoils have the appearance, in section, of nozzle-shaped channels, with their narrow ends on the upper surface of the main aerofoil. The air rushing past the narrow nozzle openings on the one hand, and the suction of the negative pressure on the upper surface of the aerofoil on the other, result in sucking air past the cambered auxiliary aerofoils, thus causing the new pressures p_1, p_2, p_3.'

" 'The total air resistance W of the aerofoil is therefore composed of the sum of the pressures p_1, p_2, p_3, etc., on the small aerofoils f_1, f_2, f_3, etc., and of the total resistance P of the larger aerofoil F respectively. These will naturally be somewhat smaller than the resistance P of a solid aerofoil.'

" 'In Fig. 2 is shown diagrammatically the constructional application of the invention to a modern aerofoil. In the space between every two ribs are arranged two plates of ply-wood, sheet metal, Cellon, or some similar material, shaped to conform to the aerofoil section. By suitably shaping the plates a smooth run into the lower aerofoil surface is possible.'

"The Patent Office has refused the application, the reason stated being that it was not necessarily to be expected that the lift of the aerofoil would be increased by the arrangement of slots. It was pointed out that, although the negative pressure on the upper surface is constantly being built up, it is being reduced by the air streaming up through the slots. To this the inventor replied in a further application: 'The vacuum over the upper surface is not stationary, as a space from which the air has been exhausted and which can be filled again by letting in air. The negative pressure above the upper surface of an aerofoil is caused by the rapid forward motion of the machine, and is built up anew every moment. It cannot, therefore, be equalized through the slots, as the air rushing over the upper curve of the aerofoil at once re-establishes the original condition of rarefaction. By way of a practical example it is pointed out that the aerodynamic efficiency of an aerofoil depends to a minor extent only on the airproofness of the fabric covering. It is quite possible to fly with fabric which lets the air through, if only the surface is smooth. According to the objections raised this should not be possible, since an equalization of pressures would occur.'

"A complaint has been lodged, and the matter is now in the hands of the Appeal Department of the Patent Office."

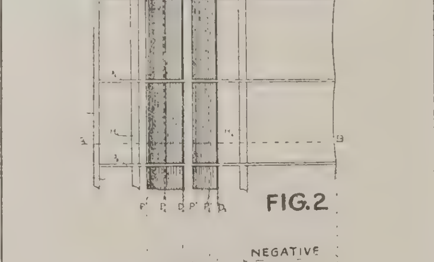


FIG. 1.

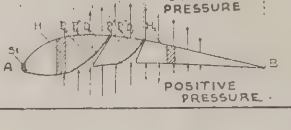


FIG. 2

Methods for Calculating Aeronautical Polar Curves

The article describes the analytical methods for computing the polar curves of aeroplanes, and introduces values for the constants therein, based upon the results obtained at the Gottingen and M. Eiffel's laboratories.

The principle of the method depends upon establishing a curve, the Cartesian coordinates of which represent the unit pressure y, and unit distance x. It is shown that y is a linear, and x, a parabolic function of the angle of incidence a. For a complete aeroplane, Rateau gives the following forms of equations, namely:

$$Y = Y_o(1 + na)$$
$$X = X_o(1 + pa^2)$$

Where $Y_o = 0.5897$, $X_o = 0.1204$, $n = 0.3$, and $p = 0.017$. The unit values x and y correspond to the K_x and K_y of Eiffel, and the German C_u and C_e.

Various equations of polar curves are given in the article for monoplanes and biplanes, and experimental values are given for the coefficients, derived from the Gottingen laboratory, M. Eiffel's, Munk's, Prandtl's and Blasius's results. Tabular values are given, showing the characteristics and coefficients in the formulæ in question for fourteen different French, English, and German aeroplane wings. The results of M. Eiffel and of the Gottingen laboratory for the calculated and measured values of x and y are compared.

The formulæ due to Munk, Blasius, and Prandtl for biplane wings are considered, and finally the polar curve for the complete machine is dealt with in general terms, and in a concrete example. A number of general conclusions are also given at the end of the article. (M. Le Sueur, *L'Aérophile,* Aug. 1-15, 1920. 4 pp.)

THE JACUZZI SEVEN-PASSENGER MONOPLANE

By JOHN H. KAUKE

THE firm of Jacuzzi Bros., Inc., of Berkeley, Cal., have designed and built the monoplane shown in the accompanying illustrations. The plane is constructed for passenger carrying or other commercial purposes and for that reason everything that could be incorporated in the design to add efficiency and safety has been used.

By the use of externally braced monoplane construction it was possible to use a comparatively thin wing section with consequent high maximum L/D at low angles of incidence and high speed. The wings have a very heavy taper in plan from the fuselage outward to the tips. This tapering made possible the use of an aerofoil section of identical proportions throughout, while at the same time the wings could be made deep near the fuselage, which has its structural advantages. The structure is of wood and linen, the beams being larger than those used in an equivalent biplane wing and there being in each wing twelve strips which tie the webs together and add much to the rigidity. External bracing is by a Y-shaped strut under each wing which passes from a tie-rod just back of the landing wheels to a point about two thirds out on the wing, where it is attached to both forward and rear beam with a heavy metal fitting. These Y-shaped struts are an aerofoil in section which fact causes them to have a noticeable dihedral effect, as they are at a considerable angle with each other. The main planes are set at a slight dihedral also. The travel of the center of pressure is small on the wing section used, and the plane has been easily recovered from a spiral nose dive as well as other positions which show that balance, etc., are properly taken care of. Ailerons are placed in the trailing edge at the outer end of each wing and are actuated by a system of tubes and cranks which connect them to the dual stick-control in a very strong and simple manner.

The two landing wheels are spaced with a seven-foot tread for the sake of aiding in landing. The wheels used are very heavy wire ones with linen streamlining applied. A two-inch axle is hung on rubber cord which allows a six-inch movement before the stops are reached. The tires are 750 by 125 mm. Streamlining in the form of an aerofoil is carried between the axle and the tie-rod which connects the wing struts. The leading edge of this aerofoil rises with the axle on landing, the remainder not moving. The landing-gear struts are heavily made of ash and are connected at their lower end by a very large, strong fitting and joining the fuselage by means of very liberal pinned ball and socket fittings. A tube passes between the two left-hand struts to serve as a step in climbing into the plane, it playing no part in the construction of the landing gear. The tail skid is a curved leaf spring.

The most noticeable thing about the fuselage is the way it merges into the center section. The ply-wood roof of the passenger compartment is also the upper surface of the center section and the passengers' headroom is therefore what would on most planes be the interior of the center section. This feature makes the ship appear small for its capacity to the casual observer. The fuselage is exceptionally strong and rigid, it being made up of six main longerons 1⅝″ by ⅞″ supplemented by eighteen auxiliary longerons ⅞″ by ⅜″, all supported by fourteen ply-wood bulkheads and covered by a ply-wood covering ¼″ thick. An aluminum casting caps the rear of the fuselage and contains bearings in which the rudder and elevators turn. Three tandem seats accommodate the seven people who make up the full load. The first seat holds two people, both of whom may pilot or, by removing one of the sticks, one may pilot and the other be a passenger. The second seat holds three and the rear one two passengers. A door on the left-hand side of the fuselage gives access to all seats, as the left side of the first and second seats hinge out of the way.

Dual or single stick control can be used. The rudder is swung by two sets of interlocked pedals, to which it is connected by a double set of cables entirely enclosed within the fuselage. An instrument board of mahogany mounts an altimeter, revolution counter, air-speed indicator, motometer, ignition switch and oil pressure gauge. Spark and throttle levers are centrally mounted within reach of either front seat. Small levers in the roof of the pilot's compartment make it possible to give the radiator shutter any desired setting while in flight and shut-off cocks are easily reached which will cut out either or both of the wing-mounted fuel tanks. A locker below the instrument board to the right holds the storage battery, while a similar locker on the left is for tools, etc. A dome like is in the center of the passenger compartment. The pilot or pilots have good forward vision through windshields on either side of the motor and with large openings on their outer side by which they can be wiped off if necessary. Side vision is through the windows, which are to be plainly seen in the pictures.

The ship is driven by a Hall-Scott L-6 motor, capable of developing over 200 h.p., using Delco ignition and two Stromberg carburetors.

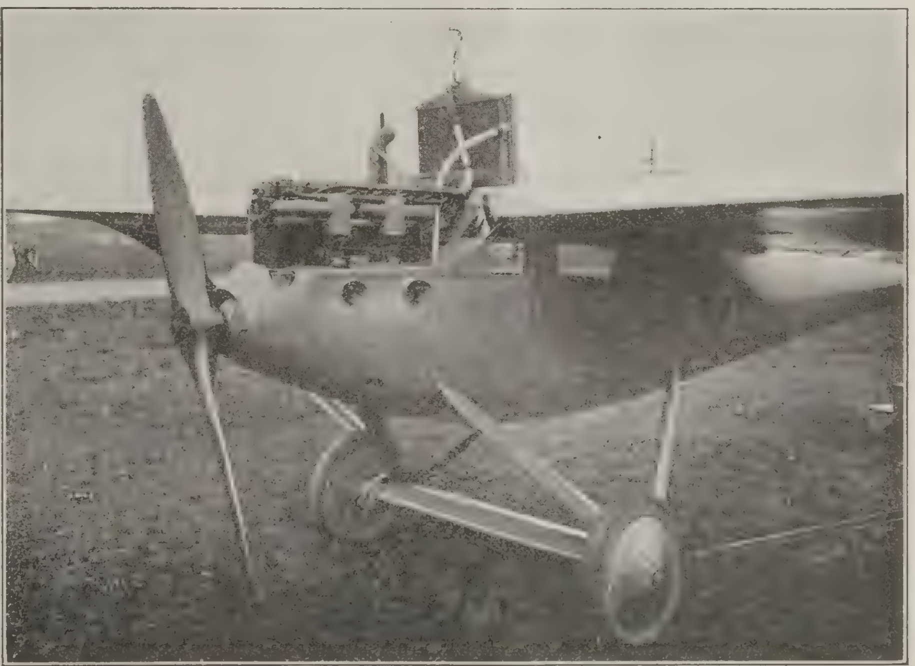
In horizontal flight, at 100 m.p.h., the motor is only called on for an output of 100 h.p., so it will be seen there is ample reserve power and that the motor is only called on for full power a very short time during any ordinary flight. The propeller used has a diameter of 8′-2″. The motor is installed with every possible precaution against fire, which will be seen by consideration of the following features: The breather fumes are carried in a long aluminum pipe clear up over the center section, eliminating any chance of their accumulating. Air comes to the carburetors through scoops which pass outside the fuselage, thus dispensing with the backfire danger. Overflow from the carburetors is conducted outside the fuselage by pipes.

The fuel is carried in wing-mounted, copper gravity tanks which are connected to the carburetors by large copper tubes, provided with flexible couplings and shut-off cocks already mentioned. Fan-driven pumps deliver all fuel to the highest point in each tank, thus maintaining a constant gravity head at all fuel levels.

The radiator is mounted in an absolutely unobstructed position and is of ample size. A heavy canvas shutter, which can be set while in flight at any desired position, rolls up at one side of the radiator when given the wide-open setting. The venturi tube of the air-speed indicator is supported above the radiator out of the propeller slip-stream and all other air disturbances.

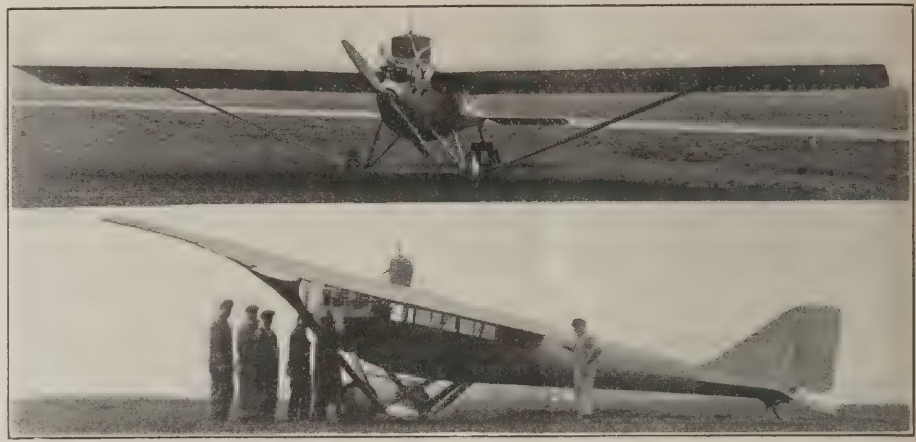
Performance and Specifications

In flight the plane proved remarkably efficient, as might be anticipated by considering the very clean design and the way every surface possible has been made to lift. The wing curve employed is another important factor toward its high efficiency, as it has a L/D ratio much higher at its maximum point than that attained by sections which can safely rely entirely on internal bracing. Two rather novel features which excited some criticism when the plane first appeared on flying fields



The Jacuzzi seven-passenger monoplane

were the single strut bracing of such large wings, it being thought twist would be present in the wings, and the fact that the axle of the landing gear does not come at the intersection of the landing-gear struts. Actual use proved both of these objections ill founded, as the wings are exceptionally rigid in flight and the chassis has stood up under some punishment sufficiently severe to collapse the wire wheels.



Front and side views of the seven-passenger Jacuzzi Monoplane

Length over all	29 ft.
Span	52 ft.
Height (to top of radiator)	10 ft., 6 in.
Wing area (including center section)	400 sq. ft.
Weight, empty (no fuel, oil or useful load)	1,800 lbs.
Weight, fully loaded	3,400 lbs.
Fuel capacity (2 wing tanks 40 gals. each)	80 gals.
Oil capacity (tank in wing)	4 gals.
Fuel consumption per hour	8 to 9 gals.
Radius of action	900 to 1,000 miles
Speed, half throttle	100 m.p.h.
Speed, three-quarter throttle	125 m.p.h.
Min. landing speed (full load)	45 m.p.h.
Min. landing speed (half load)	38 m.p.h.
Approximate ceiling	22,000 ft.

GENERAL MITCHELL ON THE AIR SERVICE APPROPRIATIONS

BRIGADIER GENERAL WILLIAM MITCHELL, Assistant Chief of the Army Air Service, made a plea before the House Committee on Appropriations January 28th for adequate funds to develop aviation as a means of military defense, especially of the coast cities. The committee in the Army Bill which was reported recently, however, recommends the appropriation of only $19,200,000 instead of the $60,000,000 which had been asked.

General Mitchell insisted that the aeroplane had become so much superior to the battleship that a well-balanced military program must include a large aerial force to be effective in the next war. He said that a sufficiently large force could be formed and equipped in three years at a cost of $45,000,000, which represented no more than the cost of a battle cruiser.

General Mitchell wanted the committee to recommend the use of the former German liners *Leviathan, Von Steuben* and *Agamemnon* as aeroplane carriers. With these fast ships carrying an air force, he said, they could be quickly carried to any zone of operations. With these ships equipped the entire Atlantic Coast could be well protected, he said.

"The vulnerable part of our country is from the Chesapeake Bay up to the Boston, and from New York to Chicago," said the General. "By having an air force ready for action somewhere in New Jersey you can reach any part of that area within two or three hours, whereas you could not do it in less than a day or two with railway guns, and then they could have little effect. You must remember that it takes an hour at least to put railway guns into firing position and we can go 110 miles an hour with our bombardment aeroplanes, much more with our pursuit. We can shift our air forces within twenty-five to thirty flying hours from the East to the West Coast, and from the North to the South in the same proportion of time.

"You must remember, also, that battleships cost $45,000,000 each, and we can build a thousand aeroplanes for the cost of each battleship.

"The whole training of the Navy is that the armored ship is mistress of the sea, whereas actually it is just as helpless as the armored knight was when firearms were brought against him."

General Mitchell said that 600 aeroplanes—60 per cent pursuit, 20 per cent attack, and 20 per cent bombing—would be sufficient to protect the Atlantic Coast, while the Pacific should have the same number. As a protection for the land, 1,200 other planes were needed, he said.

The officer asserted that, with the improvements in aviation and bombing, "any ship in existence can be destroyed today." He told how in a test attack with bombs on the old battleship *Indiana* aircraft 5,000 feet up made 11 per cent of hits.

Explaining the use of gas against cities, General Mitchell said:

"We believe that in the next war gas might be used by a barbarous foe on the centers of communication. We know just how much gas has to be put down on these centers to interrupt communication. Take New York and an area in the vicinity ten miles by ten miles. If two tons of crying gas are dropped by aeroplanes or airships there once in eight days, it will make everybody wear gas masks and goggles.

"If we want to keep that place covered with mustard gas, we can put down seventy tons once in eight days and everybody will have to protect themselves against mustard gas in that area. If we want to kill everybody in that area and use phosgene, we have to put down 200 tons of phosgene once in eight days and it will keep that area covered. All you have to do is to go over that area once every eight days and keep it inundated with gas. The only protection against such a procedure is protection in the air."

APPROPRIATIONS FOR NAVAL AVIATION

FOLLOWING is a statement made by Capt. T. T. Craven, Director of Naval Aviation, before the Naval Affairs Committee of the House of Representatives:

The Committee has before it an analysis of the estimates for Naval Aviation for the fiscal year 1922.

The estimates are divided up and analyzed as has been the case for the past two years and under the same subheads as before.

The Department submits a request for a total of $35,000,000. Considerable progress in Fleet Aviation has been made during the past year despite the difficulties connected with all Naval Operations due to shortage and the changing of personnel which have interferred with training everywhere. In the Pacific the aviation activities have been based largely in the San Diego region, where a fine climate and a shore base near to the drill ground for ships has materially assisted operations. The Atlantic Fleet has operated in the West Indies and also on our own coast, and has had conditions not as favorable as those experienced by the Pacific division of the Fleet. There has been constant effort to make aviation a fleet activity. Difficulty has been experienced because of the absence of vessels capable of adequately caring for aviation interests. The *Shawmut* and the *Aroostook,* two mine layers, have been continued as aviation tenders and have given excellent service in that capacity, despite the fact that they are not fitted for this work and have been simply loaned by the Mine Force to Aviation. If these two craft had not been with the Atlantic and Pacific Fleets, Naval Aviation would have had to continue to base its efforts entirely upon the shore. In addition to the *Shawmut* and *Aroostook* acting as mother ships for the large aeroplanes which now accompany the Fleets, the destroyers *Harding* and *Mugford* have been loaned to the two Fleets as tenders for groups of large flying boats of the NC type. In the Atlantic Fleet a mine sweeper, the *Sandpiper,* has also assisted as a tender for the purpose of aviation.

Four battleships in each Fleet have been fitted to convey planes and each of these ships has been equipped with two heavier-than-air machines, which they have flown from the turrets. A number of vessels of various classes are equipped with kite balloon winches and are prepared to operate kite balloons. A kite balloon division has been organized in the Atlantic and in the Pacific to continue development to the kite balloon operations.

While material progress has been made with Fleet Aviation, it must be clearly understood that without the conveniences and the machines permitting the development of aviation afloat with a minimum of effort and inconvenience to ships, the progress of molding aviation into the Naval establishment afloat necessarily will be slow.

I believe I am correct in stating that the difficulties for the sailor who flies are as much greater than those of the flyer over land as is the case with all of the other highly technical operations which a seaman undertakes by comparison with the work of the soldier. The development of military and naval aviation came about during the World's War and during that struggle the land operations of aviation were carried on intensely and constantly. The major effort of naval aviation was the suppression of the submarine and only towards the close of the struggle did it find a place in the fleet. The supremacy of land aviation put its stamp upon naval thought and until now the effort has been to improvise for naval purposes machines and tactics developed primarily for use over the land. Even the type of machine to be employed from ships can not be the same as that best employed from shore. Those who are unfamiliar with naval subjects and the naval problem can not understand this idea, which is in direct opposition to the view that a United Air Service is either practicable or desirable.

The aviation service which the Navy desires today, and which it must have, is an arm which will assist it to defeat the enemy at sea. This is its paramount present-day essential. In so far as this detail is concerned, and regardless of future developments, the matter now is purely a naval one which the Navy alone is competent to handle.

Because of the stress given to land aviation, the development of the land plane and of aviation tactics over the land in conjunction with troops has progressed far beyond the uncertain stage of experimentation. In the combined service which has been developed in England, the preponderance of experience and of skill and techincal talent rests with the branch, by far most numerous, composed of flyers who have won their laurels over the land. Consequently, the attempt has been to compromise and to adapt the land type of machine to naval purposes. Development has been slow for two reasons: first, because Great Britain has two services in the same ship occupied with a common problem. It is not difficult to understand why progress has been impeded as a result of this arrangement. A second obstacle has been that incidental to the attempt to compromise the land type and to improvise the machines for ships' use rather than to attack the problem of the design of a machine for overseas work directly, which is distinct and separate from that involved in the design of land machines. There are certain principles which must be embodied in machines to be used from ships. The first is (a) flotation, which provides reasonable safety for the pilot and for the machine. Unless flotation is supplied which insures reasonable safety, the development of the tactics of aviation for naval purposes will not proceed, as the commander-in-chief and the commanding officers of vessels employing aircraft will not wish to hazard the aviation personnel in developing the tactical usefulness of aviation in time of peace and in studying the tactical employment of this arm. Consequently, interest in aviation and the application of aviation, in so far as the Navy is concerned, can not be obtained unless this characteristic is given to naval planes. An effort to compromise the land type of plane by fitting it with air bags for work over water has not been satisfactory as a means for fulfilling naval requirements.

A second quality essential for naval planes is (b) ruggedness and dependability, capable of being easily and quickly taken down and assembled, and when taken down, capable of compact stowage.

The conveyance of planes on the decks or turrets of ships adds one more mental burden to the great load carried by the captain of a naval unit. Planes carried on decks or turrets are very much in the way and one can not expect to find planes in general use from various types of ships until machines have appeared which can be taken down easily and stowed inboard out of the weather and in a way in which they do not interfere with ship activities. It would seem that we must look to metal as material for assisting us to obtain this characteristic. Features which permit the quick taking down and assembly of planes are of far greater importance to the Navy than to the Army.

The third attribute to be incorporated in a naval plane is (c) ability to fly from a vessel, either directly or assisted, and to land on the deck of a vessel or in the water. The necessity for this characteristic is self-evident and in order that planes may be carried in different types of vessels it is essential that they may get away from the ship with a very short run or that a machine such as a catapult be supplied by which they may be projected into the air. A plane must be fitted to land on a deck or on the water. The land flyer is not concerned with these details.

A fourth attribute is (d) low landing speed. It can be readily seen that the closer the speed of a plane approaches the speed of a plane carrier—the ship upon which she desires to land—the easier a landing becomes upon the deck of such a vessel. A plane with an excessively high landing speed can not land upon the deck of a carrier. The importance of low landing speed is supreme for planes to be conveyed in ships of the carrier type.

Having accepted the four above-mentioned characteristics as essentials, we then have a fifth which must be included in order that a machine carried by ships may serve a useful end. Such a plane must be (e) capable of conveying and of usefully applying military power. This involves performance, ability to communicate, and the employment of weapons.

It is evident that these characteristics can not be secured without sacrifice to some degree of the high performances now given to the plane of purely a land type, but the Navy must accept this penalty in the aviation arm as it does in all the arms conveyed in surface and subsurface vessels.

If one considers the five characteristics enumerated above and has knowledge of the conditions of the art as it exists today, it becomes evident that the naval problem is far from solution and it is seen that the time for standardization in so far as naval types are concerned is far in the future.

In other words, development of naval planes can only be carried on experimentally and it is of vital importance that the operator and the designer work closely hand in hand. Standardization is as yet impossible. The proposition to combine the production of machines for the Army and the Navy therefore is illogical and can only result in delaying the naval branch in its effort to acquire the apparatus which will permit it to definitely give to aviation the place belonging to it in naval affairs.

Steps to Be Taken for the Procurement of New Types of Machines

The following steps must be taken in order to attack directly the problem in hand by the Navy for the procurement of machines adapted to its use:

(1) Encourage designers to develop planes suitable for naval purposes, through competition or otherwise.

(2) Encourage manufacturers to produce planes of different sizes incorporating the above requirements, through contracts.

(3) Improve and augment the experimental facilities of the Aircraft Factory and enlarge the technical designing force.

(4) Investigate and purchase abroad any types of aircraft which seemingly are well adapted for our purposes.

The development has proceeded along the lines indicated above. The lack of technical designers is felt keenly, particularly as many Reserve Officers who were employed in work of this nature have left the service, and with the departure of each one an unfilled vacancy in an important field remains. It is earnestly hoped that the limitations in regard to the amount which may be spent for classified and technical employees may be increased in order to permit the Navy to proceed with the important work in hand. The solution of our problem has been retarded for lack of a carrier with which to carry on our experimental work. The conversion of the Langley (*ex Jupiter*) will be completed during the coming spring and when that vessel becomes available we will be able to make a start toward the solution we desire. A bigger and a faster ship than the *Jupiter* must be provided, however, before we can hope to attain final results.

The conversion of the *Wright* has been delayed and that vessel will not be ready for many months. When commissioned the ship will serve a most useful purpose as a base or tender for large seaplanes and for a kite balloon unit.

Funds for experimental work should not be curtailed, and pending the development of machines best adapted for use from shipboard planes not so excellent for naval purposes must be supplied in sufficient numbers to permit the development of organization and skill of personnel.

The personnel of aviation during the fiscal year 1922 is expected to be about 800 officers and 7,000 men in the Navy and 124 officers and 1,100 men in the Marine Corps. At present a total of 631 officers are employed on aviation duty, of whom 362 are aviators and 53 student aviators. We have a total of 60 heavier-than-air and lighter-than-air enlisted pilots and a total of about 7,200 enlisted men employed in aviation duty, of whom 3,000 are at the Training School at Great Lakes.

A detachment of 15 officers and 45 enlisted men is on duty in England in connection with the construction of the rigid being manufactured for our Naval Service. This contingent is being instructed in the operation of rigids by the British. The completion of the ship has been retarded somewhat, as has also been the hangar intended for her reception in this country. It now looks as though the vessel would be completed in March and the hangar at Lakehurst would be ready for occupancy on July 1st. It is probable that the ship will make the passage across the Atlantic early in July.

During the year shortage of personnel made it necessary to place the air stations at Chatham and at Cape May on an inoperative basis. These stations have been closed and placed under caretakers.

The station at Rockaway has operated throughout the year. The amount of money spent at this place has been kept low and nothing has been spent on public works beyond what was absolutely necessary for upkeep. The matter of the acquirement by the Government of the land on which the station stands has been taken up with the authorities in New York, but no arrangements have been consummated to this end.

It is evident that it is of great importance to the Government to preserve aviation facilities in the neighborhood of large centers of population. Only through the maintenance of such establishments interest in flying on the part of many individuals who would be immediately useful as flyers in the event of war can be sustained and a reserve of aviators perpetuated.

There has been considerable progress in the completion of the station at Hampton Roads, which during the next year will become our important aviation operating base on the Atlantic Coast.

There is no aviation station south of Hampton Roads within the continental limits of the United States, with the exception of the school at Pensacola. The activities at this place have been augmented considerably during the past few months because of the larger classes which are now being sent there made up of officers of the regular Navy. This is probably one of the most active flying schools in the world.

A small station at Coco Solo in the Canal Zone, established during the war, has continued to struggle on with the limited conveniences supplied during hostilities. The importance of supplying adequate facilities insuring the protection of the Panama Canal would make it evident that a considerable sum should be devoted to the improvement of the aviation facilities in the Canal Zone in the near future. Better provision should be made for the housing of personnel stationed at this post.

On the West Coast, San Diego has been a very active center during the past twelve months, and the importance of this point will increase during the coming year. Up to the present no decision has been reached in regard to the site for the rigid hangar for the construction of which money was appropriated by Congress last year.

It is expected that contracts for the establishment of the station at Pearl Harbor, authorized by the last Congress, will be let in the near future.

The Great Lakes Mechanics' School has continued to fill a most useful rôle and is engaged in the training of aviation mechanics. Every one who has visited this institution has been impressed with the excellence of the course given to young men sent to this station. I believe it to be one of the leading, if not the leading, manual training school in the world. The only flying facilities at Great Lakes are those supplied during the war by private contribution, and it would seem most desirable that a hangar should be erected at this place which will permit flying in this locality. The Department has been seriously embarrassed during the past year because of the lack of facilities in this neighborhood where there is little that can be supplied Reserve Officers for the purpose of continuing their flight exercises and flight training.

The development of the torpedoplane is being undertaken seriously by the Navy Department. In order to carry on this work it is necessary to have flying facilities at places where it is convenient to run torpedoes. During the past year we have endeavored to carry on torpedo work at Yorktown, but in order to insure the progress which we desire, the Bureau of Ordnance is very anxious that facilities permitting the use of aviation should be created near the torpedo station at Newport.

It will be noted that no money has been requested for seaplanes, as it has been assumed that the planes left over from the stock accumulated during the war will be available for another eighteen months. It costs a considerable amount to recondition these machines, but the large boats on hand are well worth this expenditure.

In the estimates presented to the Committee, it will be noted that a total of 67 heavier-than-air planes are requested for the Navy and 61 planes for the Marines. This is a very conservative number; certainly it would seem impossible for us to do with less, and were it not for the large number of seaplanes on hand which will also be utilized, a far greater number of heavier-than-air craft than the 128 requested should be authorized.

Lighter-than-air activities everywhere have been very much curtailed. With the commissioning of a tender which will permit the better employment of the kite balloon, greater interest in the use of these units is to be expected. At the present time operations with kite balloons in the Fleet are attended with serious difficulties.

The war definitely determined the airship to be primarily a naval unit. The Allied navies found the non-rigid airship to be of value in the anti-submarine campaign in convoy and patrol operations. The Germans demonstrated the usefulness of the rigid as a naval scout, after abandoning this type for offensive overland operations.

The rigid airship in its present state of development has a wide cruising radius and an ability to stay in the air for long periods of time. Owing to the excellent visibility and weather conditions prevailing in the Pacific and West Indian areas rigids would be of tremendous value in event of war to a fleet operating in these theatres.

The small non-rigids requested will always be useful for coastal work in time of war and are valuable as training units for lighter-than-air personnel. After his course in non-rigids, the pilot should then be competent to begin his instruction in rigid airships. During the coming year we will have one rigid in operation and one under erection in this country. We can not expect exhaustively to study the usefulness of rigids for naval work with but two ships of this character, and it is to be hoped that the Congress will see fit to continue our development in this line.

The Department has a giant seaplane under construction. A small amount of money has already been expended on this project from that appropriated for experimental work. The constuction of a great ship along the line proposed by the Department is directly in the road of progress and should be continued. A considerable sum is requested for construction of stations, and a considerable part of this sum is to be devoted to construction in the Philippines, at Dutch Flats, and on the Pacific Coast rigid station.

The disinclination to appropriate unduly for naval shore activities is thoroughly appreciated and unquestionably ideas on this line are entirely correct, but it is submitted in passing that aviation is a new branch which does not fit itself readily into any of the naval shore establishments and bases already in existence, and facilities permitting flying must be created before flying can be conducted. All naval operations of every kind must always be based upon the land. This is true for work with ships as well as aircraft, and consequently any money wisely spent in shore development is a permanent asset and can not be wasted in so far as aviation is concerned.

In the estimates for maintenance of stations, effort has been made to cut, and figures have been based upon actual performances during the past year. The fund for experimental work is believed to be the minimum that should be supplied. The matter of anti-aircraft research and methods for withstanding aircraft attack has recently been investigated by a board in the Navy Department, and it is evident that a considerable sum must be devoted to this important work. The recommendations of this board were not received until after the estimates herein contained had been submitted, but it is believed that the amount requested by the board ($1,000,000) can be covered in the total of $35,000,000 recommended for aviation purposes during this year.

It will be noted that an increase of $125,000 is proposed for drafting, clerical, and technical service. All progressive experimental and design work in aviation has been very much retarded through the lack of trained and skilled technicists. This is particularly the case now that many of the Reserve Officers, formerly employed in technical capacities, have left the service. Something must be done to enable the Navy to retain adequate technical assistance in order to insure the development of aviation.

FIRST SEMI-ANNUAL REPORT OF THE CIVIL AFFAIRS DIVISION OF THE ARMY AIR SERVICE

Introduction

"TACTICAL success in war" is the *raison d'être* of the Air Service as of any other branch of the Army. It is for this purpose that the Air Service exists. Training and Operations Group has under its jurisdiction the instruments, including units, personnel and material, that will bring about this tactical success of the Air Service. It is a recognized fact that there are two functions for aircraft in war. One, service to the Army, co-operating with troops on the ground; the other, what might be termed independent or combatant, operating in the air, irrespective of land definitions or of the location of the Army units and in comparison with that portion of the Air Service that operates as an auxiliary to the Army many times larger in numbers, more highly complicated in organization and tactical control and more mobile than the other auxiliary that is purely and distinctly Army Air Service.

Under the Army Reorganization Act of June 14, 1920, only sufficient Air Service was provided to suit Army needs. With the exception of a very small nucleus of pursuit, bombardment and attack, no provision was made for the maintenance of the independent or air force side of military aviation. It became quite evident that from a financial standpoint, if from no other, the Chief of Air Service would have to adopt a policy of maintaining a small but highly efficient Army Air Service depending for the strength on mobilization in an emergency upon the large reserves of personnel and a well-established aeronautical industry for its material out of which will be built the combatant force. This meant that commercial aviation had to be fostered in much the same way as the merchant marine.

With the beginning of the fiscal year on July 1, 1920, one finds little or no organized commercial industry in the United States. No legislation existed that would warrant the promotion of a large air transportation company, although in reality many small operators had sprung up and were struggling along throughout the country in a more or less independent manner, unrecognized by any Government body, uncontrolled either by State or Federal legislation, at best a temporary proposition, hanging on until that time when their efforts would be appreciated as a national asset in a legitimate industry.

In the course of its training and maneuvers the Air Service constantly came in touch with the private enterprise and it is only natural to find it acting in many specific localities as a big brother to some small operator. With no extra expense the War Department found itself in a position whereby it could assist in the building up of a commercial reserve, furnishing, as it were, for their benefit certain unused by-products of the daily routine of the Air Service activities. These by-products included mainly information on aeronautical subjects, landing fields recognized and used by the Army, and such other assistance of this nature as legally can be furnished the struggling operator.

Undoubtedly commercial aviation will, if left to itself, grow and become of its own impetus a healthy component of the nation's machinery. But under the influence of the Army Air Service it will grow more quickly and at the same time be organized and built up in such a way that it can readily, in the event of an emergency, be trained to good use by the nation. Just as the Training and Operations Group must provide for the building up and organization of the reserve unit, so it must look out for this potential reserve, and on August 28, 1920, a recommendation was made to the Executive embracing the new division and outlining the functions of the group as they were construed at that time. This was approved, with certain changes, by the Executive on September 8, 1920, and Training and Operations Group in a memorandum dated September 14, 1920, set forth suggested changes for Pamphlet 10 and outlined the functions of Civil Affairs and the internal organization thereof.

Further conferences with the Advisory Board have been held on this subject to define clearly the functions of commercial aviation as carried on in the Information Group and in Civil Affairs, and the Information Group sends out such data on commercial aviation as is a matter of fact or record, while Civil Affairs Division, as part of the Training and Operations Group, fosters commercial aviation in conjunction with the regular activities of the Group, sending out opinions or advice based upon actual operations and working out, where necessary, new problems. Civil Affairs Division has access, through the Chief of Training, to all troops and planes of the Air Service and must at all times consider our plans with a view to recommending such changes as may produce results that will foster commercial aviation.

Upon removal of the office of the Chief of Air Service from temporary Building "B," 7th and B Streets, N. W., to its present location in the Munitions Building on September 25, 1920, the Civil Affairs Division began business. Captain Hartney, until November 1st, was unable to devote his full time to the organization of the Division because of the fact that he was Acting Chief of Operations, but since the return of the Alaska flyers he has been able to devote his entire time to the Division.

Under the approved organization of this division there are four sections. Owing to the shortage of personnel and undeveloped condition of the whole division, the Chief of the Division has had to be content with one assistant only, who has had charge of the Photographic Section. Lieutenant Goddard reported to the division October 14, 1920, and is substituting for Lieutenant Wheeler, the present section chief, who is about to take flying training. While no actual officer has been in charge of each section, the Chief has attempted to maintain the distinction and the organization so that as the division is built up all of its activities will be looked out for, responsibility placed, and each co-ordinated in due course.

Legislative Section

All recommendations for legislation made by the Chief of Air Service must in due course go to the War Department. This section is concerned, therefore, only with such legislation as will enable the operators of aircraft in the Army to foster commercial aviation.

During the life of the division the only control the Air Service has been able to exert over the commercial operator is to insist on the obedience to Army rules for civilian planes upon landing on Government fields and by urging, where possible, the use of the standard flying and aerodrome rules of the Air Service now in force at all its activities. In several cases this has been done so that virtually the Chief of Air Service does exercise a certain control over the commercial operator. Until such time as legislation designates a body for this purpose the work of this section will be extremely small.

Airways Section

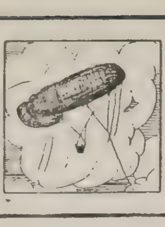
The function of this section is to construct and supervise airways, municipal landing fields, advise on forest patrol and all other civilian activities of the Air Service. During the period September 25th to December 31st one of the accomplishments of the division has been the preparation of a project for the development of airways throughout the whole of the United States by the Corps Area Commanders and stations under them, the work to be in the ordinary course of training and maneuvers. This project has been submitted to the Chief of the Group and has received his approval.

The construction of a model airway is under way, the work on this particular case being assigned to Bolling Field. The model airway is in the nature of an experiment which will permit of the necessary orders to all the Corps Area Commanders in due course. The Commanding Officer of Bolling Field is co-operating with the Chambers of Commerce and other municipal organizations en route. The radio development which is to occupy such an important part in the success of the route will of necessity be slow. This requires further training of the personnel interested and this includes pilots. Some of the equipment is not yet manufactured, but progress has been made on the installation in the planes of the necessary antenna and with the location of a field at Wheeling and the erection of a hangar there, it will be possible to actually start radio operations, at first reporting weather conditions and communicating with Langley, Mitchel, Bolling and Dayton, later establishing communication with the planes themselves.

Some of the other projects of this section are worthy of note, for their influence on the development of commercial aviation will be far-reaching and serve as a background to the subsequent development. These projects are as follows:

Development of Aeronautical Maps.—In conjunction with the Information Group and the Navigation Experimental Officer at McCook Field, this division is recommending certain changes in the conventional signs now in use for marking maps. This is the first step taken by this division towards obtaining for flyers a suitable map that will be beneficial not only to the military pilot but to the commercial as well. With the establishment of the airways it will be possible to work up a very satisfactory flyers' map using oblique and vertical views to show the landing fields.

(To be concluded)



FOREIGN TECHNICAL DIGEST

Aeroplanes in Electrical Transmission Service

The San Joaquin Light and Power Corporation has decided to build aeroplane landing fields in connection with each of its mountain projects.

This will enable aeroplanes to be used for the transport of light machinery and materials in connection with mountain engineering construction. Also it will facilitate the delivery of material for repairs, it will permit engineers to supervise and operate equipment over a much larger area of country, and it will make possible a regular patrol service, such as is already used in the Western forest service. Wherever distances are long and the country is difficult, the aeroplane offers important possibilities in connection with engineering development and supervision, particularly if there are no roads or railways through the country concerned. (*Journal of Electricity*, September 1, 1920. 1 col.)

The Sablatnig Sport Type

This article describes the recently developed Sablatnig single-seater sport type monoplane. It is equipped with a 20 h.p. R A W motor, and its total wing area is 110 km. The wings are externally braced and outside of its careful stream-lining it has no particularly notable features. (*Illustrierte Flug-Welt*, December 22, 1920, 2½ pages, 3 illustrations, 1 diagram.)

The Latham Seaplane

This article describes in detail the Latham triple-motored seaplane. It is equipped with Panhard-Lavassor 340 h.p. motors; is 18.20 meters in length, 6 meters in height and has a total surface of 180 square meters. Its total weight, loaded, is 7,200 k.g. It is stated that the Latham Company contemplate the building of a four-motored seaplane for commercial work in the near future. (*L'Aeronautique*, November-December, 1920, 2 illustrations, 2 diagrams.)

Photography from Aeroplanes

In a previous article the method of taking photographs from the air and using same for drawing accurate maps has been explained. It might be of interest to study the technical side of the question and to see how it is applied to the reconstruction of devastated areas.

The photographs are taken with a high-speed camera (120 to 150 plates per hour), the camera being fitted with a lens-shutter capable of good results at 1/200th of a second. The conical perspective obtained by the "Roussilhe" method is deformed by a special system, taking into account the relief of the ground. Errors on the existing maps, ranging from about 2 ft., have been found and corrected. Such a service embodying all the latest developments will be shortly available for the reconstruction of the devastated areas. (H. Roussilhe, *La Nature*, Sept. 25, 1920. 4 pp., 5 figs.)

"High Altitude" Physiological Tests Carried Out at the "Institut Aerotechnique"

This article describes and illustrates physiological tests similar to those that have recently been carried out by certain experimenters in this country in order to determine the effects of flying at high altitudes. (*La Nature*, Sept. 4, 1920. 7 cols. 3 figs.)

Recent Albatros Machines

Particulars are given of six dfferent types of aeroplane made by the Albatros Company known respectively as the L.6 two-seater 160 h.p. military type, the L.21 two-engined pusher bomber of 400 h.p.; the L.27, 260 h.p. military type; the L.47 two-seater post-war machine, designed for fast work; the L.43 single seater 160 h.p. sporting type, and the 120 h.p. flying-boat monoplane, known as the W.10 type. Photographic illustrations and the chief characteristics and performances are included in the description. (*L'Air*, Oct. 20, 1920. 2 pp., 3 figs.)

The Zodiac Dirigible

The description refers to the small Zodiac dirigible intended for sporting or touring purposes, fitted with a 50 or 60 h.p. engine. The nacelle is totally enclosed, with a coupe-typed body for the two occupants. The capacity is 1,000 c. metres, and the dirigible has a range of 300 kilom., at 60 kilom. per hour. (*L'Air*, Oct. 5, 1920. 1½ pp., 3 figs.)

Recent Spad Machines

The article describes the following machines, namely:

(1) The Gordon-Bennett 1920 monocoque single seater fitted with a 300 h.p. Hispaño-Suiza engine, known as the "S.20 bis" type, and which is capable of a maximum speed of 225 kilom. per hour. (2) The training machine, "S-34," fitted with an 80 h.p. Le Rhone engine. (3) The "S-33 bis" type, fitted with type Z-9, 275 h.p. Salmson engine, six-seater. Reference is also made to the S-36 type two-seater fighter with a 300 h.p. Hispaño-Suiza Rateau engine, the S-39 marine type,, and finally a ten-seater Napier-Lyon 450 h.p. Particulars of the principal dimensions, characteristics, and performances are given. (*L'Air*, Oct. 20, 1920. 2 pp., 4 figs.)

Induction Systems

A description of several different kinds of lay-outs with useful tabulated figures, of aircraft engines.

In any multi-cylinder engine there are two important considerations in the induction pipes, (1) absence of mutual interference and (2) freedom from deposition and condensation. The shorter the induction pipe the better. Five types of engines are dealt with, (1) Six Cylinder in line, (2) Eight Cylinder 90°, (3) Twelve Cylinder V, (4) Radial, (5) Rotary.

The writer considers that each cylinder should be fed by short direct pipes, avoiding sharp bends. In V engines the induction arrangement is often cramped, and in radial engines the lower cylinders tend to obtain a rich mixture at the expense of the upper. The induction pipes should be warmed in aero engines owing to condensation from low temperatures at high altitudes, but the actual manifold obtains sufficient heat from the cylinder heads. The mounting of the carbureter is important, and if two or more are used the throttling should be synchronized. As regards the more thorough atomization of the fuel, the author suggests further developments where the fuel issues from a jet placed at right angles to the incoming air instead of co-axially with it. (T. L. Sherman, *Automobile Engineer*, Nov., 1920. 7 pp., 28 figs.)

The Blackburn "Swift" Torpedo Plane

This aeroplane, which was exhibited by the Blackburn Aeroplane and Motor Co., Ltd., at the Aero Exhibition, Olympia, London, in July, 1920, is the latest model of torpedo-carrying ship aeroplane. Official permission to exhibit was granted on condition that certain special equipment—notably the torpedo gear—was not shown, and for an equal reason this gear cannot be described. Hence the machine exhibited may be regarded simply as a ship aeroplane of high performance and high-load-carrying capacity.

As regards behavior in the air, the design gives a high measure of stability, allowing "hands-off" flying for long periods, whilst the arrangement of controls renders muscular effort negligible. Manœuvrability is excellent, owing to the skilful concentration of loads on the turning axes.

As a ship aeroplane, the "Swift" is fitted with airbags for flotation in the event of forced landing at sea and with wheels, automatically removable in the air, to render such landings safe. Slings for hoisting aboard ships are also fitted. To facilitate stowage on shipboard, the machine folds its planes, and the folding gear is of interest not only for its sound mechanical design, but also because it is the first gear to allow the folding of staggered-planes; this permits an appreciable improvement of the pilot's view and a slight increase in performance.

Span (open), 48 ft. 6 in.
Span (folded), 17 ft. 6 in.
Length, 35 ft. 6 in.
Height, 12 ft. 0 in.
Engine, 450 h.p. Napier.
Total weight, fully loaded, 6,000 lb.
Useful load (including crew but not fuel), 1,975 lb.
Fuel capacity, 4 hours' full power.
Mainplane area, 720 sq. ft.
Full speed, 98 knots.
Landing speed, 43 knots.
Getting-off speed, 40 knots.
Run to unstick, 40 yards in 20-knot wind.
Range, 392 nautical miles.
Rate of climb, 850 ft. per min.
Service ceiling, 15,000 ft.

Purely as a torpedo-carrier the aeroplane must adequately carry, aim and fire its torpedo. A modern torpedo forms in itself a very high load for a small machine, whilst conditions dealt with below show urgent need that the size of machine shall not be increased to simplify this difficulty.

Efficiency in aiming is a question partly of general excellence of view, partly of mechanical excellence in instruments. The pilot's view must embrace without material obstruction the whole area forward, sideways and downward. He should be able to observe freely in these directions without undue movement and without adopting any attitude which will take his attention from the controls.

The controls and releases for the torpedo must be simple, reliable, and few in number, so as to give instantaneous, accurate and certain action. The aeroplane itself must be robust and elastic in construction to withstand the sudden and heavy strains due to the flying manœuvres which accompany the act of firing. (*Aeronautics*, Dec. 30, 1920. 1 p.)

NAVAL and MILITARY AERONAUTICS

46 Times Around the World

During the year 1920 pilots at March Field have flown a distance equal to 46 times around the globe. Jules Verne's hero accomplished the feat of going once "around the world in 80 days." According to March Field statistics, this record would be far and away bested, as 46 times around in 365 days would reduce the time for one circumnavigation to 7 days, 26 hours and 26 seconds, to get down to very minute details.

A more logical calculation, of course, would be to divide 25,000 miles, the circumference of the earth, by 80, the rate in miles per hour, and again divide this quotient by 24, the number of hours in a day. The result thus obtained would be 13 days, the time required to make one circumnavigation of the globe.

Ballooning in California

Ross Field, Arcadia, Calif.—Two free balloons from this field made a series of flights around the first of December. The larger, a 24,000-cubic-foot balloon, left the field at 8:28 a. m., carrying Lieut. Clarence H. Welch, A. S., as pilot, and Cadets Guy W. Brown, Lloyd L. Berger and Kenneth L Frazier, as passengers. It made six flights of approximately an hour's duration each, traveling in a general easterly direction On the last three flights but two passengers were carried. Cadets Kenneth L. Frazier and Ronald L. Short, Lieut. Welch piloting. The final landing was made near Long Beach at 2:45 p. m., after covering a distance of about 55 miles The other balloon, of 12,000 cubic feet capacity, made three solo flights of an hour's duration each. The first was made by Cadet John B. Strider, the second by Cadet William J McCracken and the last by Lieut. Clarence P. Kane, A S. A final landing was made at El Monte, California, at 12:22 p m. These solo flights qualified each of the three men for pilot's licenses. Both balloons and crews returned to the field in the evening.

Hawaiian Department Army Air Service

Extensive activities have been begun on the erection of permanent buildings on this post, the total expense of which is to be covered by an appropriation of over a million dollars. According to the present plans, Ford's Island is to be used jointly by the Army and Navy; the Army to occupy the strip along the northwest coast, and the Navy that along the southwest coast, while the flying field, in the center of the island, is to be used by both. An appropriation for the Navy equally as large as that of the Army has been made and was announced recently. These expenditures will result in the establishment of one of the most complete and modern flying bases in the service, to say nothing of its beauty and attractiveness as a post.

All preparations have been made for the flight of two HS2L boats to the Island of Hawaii, the largest island of this group. Major John Curry, Department Air Service Officer, and a crew of enlisted men will precede the flight by several days for the purpose of preparing for their arrival. The officers who will proceed by plane are Capt. Allen, Lieuts. Wooten, Duke, Duncan and Gale, Air Service, and Capt. Johnson, Medical Officer. A week will be spent by the flight making reconnaissance of Hawaii in the interests of the Air Service, both by air and on the ground.

Air Service Display at Los Angeles

One of the most attractive air service recruiting displays ever presented in southern California has been installed on the fifth floor of Bullock's department store in Los Angeles. In addition to aerial equipment and an educational display, a French Spad has been erected on the roof garden. Lieut. A. B. Pitts of this school is in charge of the exhibit.

Five Service Squadrons for Mather Field

Sacramento.—Under plans which have been approved at Washington, Mather Field will become the largest air service garrison in the western department of the army, with five air squadrons and approximately 1,000 men.

Arrangements to increase the force are being made by army recruiting authorities, it was declared, and the war department has authorized an immediate increase of 585 men in the air service and about 40 men in other branches.

Mather Field is the forest fire protection center for forests of all western states.

Personal Pars

Lieut. Roscoe Turner is making his headquarters at Columbia, S. C., where he is doing excellent work with a Curtiss Oriole.

Aerial Gunnery Match at Luke Field

Aerial gunnery teams representing the Fourth and Sixth Squadrons of the Second Observation Group met in competitive gunnery matches at the Schofield Barracks range on Saturday, December 18th. The match was the first to be conducted in this department, and, as far as has been ascertained, the first in any department of the service, where squadrons competed against each other. The best score of the day was made by Lieutenant Maitland, pilot, and Lieutenant Moorman, gunner, Sixth Squadron, who made a team score of 12.2 per cent. A ten by ten target with a 30-inch bull's-eye was used—horizontal for gunners and vertical for pilots.

Training Schedule at Officer's School, Mitchel Field

The winter training schedule for flying personnel was inaugurated last week with the opening of an Officers' School. Thirty-nine officers are taking the course, which is arranged as follows: Topography: Monday, Wednesday and Friday mornings; Instructor, Major Henry Abbey, Jr. Administration: Tuesday and Thursday mornings; Instructor, Major Th. C. Lamphier. Aerial Tactics: Tuesday and Thursday afternoons; Instructor, Major A. R. Christie.

Other courses will be added and lectures covering special phases of Air Service work will be arranged according to the progress and needs of the organization at this Post.

New Board Members A. N. A. S. A.

At a recent meeting of the Board of Control of the Army and Navy Air Service Association, Maj.-Gen. Charles T. Menoher, Chief of Air Service, president, the following members were elected: Maj. Walter G. Kilner, U. S. A., Maj. Oscar Westover, U. S. A., Maj. J. R. Moulthrop, U. S. A., and Maj. Alfred Ely (Reserve Corps).

A. S. M. S. Moves to Chanute Field

Orders have been received at Kelly Field for the removal of the Air Service Mechanics' School to Chanute Field, Rantoul, Illinois. Lieut. L. W. Motley, adjutant, and two other officers and ten enlisted men will start immediately for Rantoul, Illinois, to make preparations for the arrival of the personnel and equipment of the school, according to orders drafted at Headquarters Eighth Corps Area.

The first train of air students will leave for Rantoul on January 20, 1921, besides the party which is to leave Kelly Field on January 8, 1921. This is the first move of the school personnel to Rantoul, Illinois, the new station. Civilians employed in the Mechanics' School will leave on a section to start about January 25, 1921. Lieut. H. A. Shevlin, Air Service, has been appointed adjutant of the school to succeed Lieut. L. W. Motley during his absence, who leaves with the advance group.

Bombardment Detachment at Kelly Field Discontinued

The Cadet Detachment, with its dual flying and advanced training stage, has been discontinued and the cadets have been apportioned and assigned to the four squadrons of the group. All training will, in the future, he carried out within the squadron.

This change gives each squadron an average of about eighteen pilots for duty and brings them up to a good flying strength. Each cadet has been given the work of assisting an officer in charge of some department, such as Operations, Engineering, Adjutant, Flight Commander, Supply, etc. We look for very smooth running organizations in the near future.

Pursuit Aeroplanes in Production

The first aeroplanes to be delivered under the production orders for pursuit types have been received at McCook Field and assembled for test. The Thomas-Morse MB-3, powered with 300 horsepower Wright engine, of which fifty have been ordered, is being flown to insure that the construction and operation is entirely satisfactory before proceeding with the delivery of the remaining forty-nine aeroplanes.

The first production model of the Orenco "D," of which fifty are being built by the Curtiss Company, has also been received and is being assembled to undergo acceptance tests.

Personal Par

Maj. Reed Chambers, American ace, was recently elected to the presidency of the Allied Fliers' Club, San Francisco.

FOREIGN NEWS

Appointment of Civil Controller in Australia

It is reported that Colonel Brinsmead (late Australian Flying Corps) has been appointed to hold the post of Controller of Civil Flying by the Federal Government.

A New Company in Australia

Under the title "Northern Territory Aerial Services, Ltd.," a new company has been registered with headquarters at Winton (North Queensland). The organizers of the new company are Lieutenants Hudson Fysh, D. F. C., and P. J. McGinness, D. F. C., D. C. M., the total capital being £100,000, half of which will be called up immediately.

Honors in French Aviation

In the *Journal Official* the following promotions and nominations to the various grades of the Legion d'Honneur are announced:

Grade d'Officer—M. Louis Breguet, Director of the Société des Ateliers d'Aviation Breguet; M. Alfred Leblanc, President of the Chambre Syndicate des Industries Aeronautiques; M. Rudolphe Soreau, Vice-President of the Aéro Club de France.

Grade de Chevalier—M. André Herbemont, Technical Director of Blériot Aeronautique; M. Marcel Vuillerme, Chief Engineer of Etablissements Brequet; M. Louis Capazza, Vice-President of the S. F. N. Ae.; M. E.-M.-J. Montgermon, Director-General of the Etablissements voisin; M. E.-M.-G. Lepèpre, Engineer of the S. T. Ae., designer of the American Lepère fighter; M. Eugène Serre, Director-General of the Maison Farman; Dr. Garsaux, Chief of Aeronautical Medical Service; MM. de Lafreté and Jacques Mortane, whose articles on aeronautics are well known in France; and M. E. Bossoutrot, pilot of the Farman firm.

Newspapers By Air

It is reported that a scheme is being discussed whereby certain London daily papers are proposing, in the early spring, to send papers by air so as to enable them to be sold on the Paris streets by 8 A. M.

French Aerial Police Force

It is reported that France is contemplating the formation of an aerial police force for the purpose of guarding her frontiers against smugglers or persons attempting to land without official passports. The Ministry of Aviation is arranging definite points along the frontiers over which all aircraft must pass and for aerodromes where customs inspections will be made. Aeroplanes which cross the frontier elsewhere will be signalled to come down, and will then be followed to the nearest landing place by the aerial police, unless these aeroplanes belong to special aerial transportation companies owning their own aerodromes, where customs officials will be stationed permanently.

Apart from the supervision of frontiers to prevent commercial infractions of the laws the aerial police will be expected to keep constant "lookout" for the approach of enemy aircraft.

Report on British Air Ministry Competitions

The Judges' Committee, responsible for the Government competitions which were held during August and September, with the object of ascertaining the best types of Aeroplanes and Amphibians, have now issued their report.

Details regarding the Rules of the Competitions, the entries received, the actual competitors and the prizes awarded have already been published.

The broad, general conclusions of the above Committee are summarized as follows:

One effect of the rules of the Competitions was to encourage the production of aircraft having an ample reserve of power. To obtain this reserve without sacrificing economy or useful load entails the use of an engine of high power for its weight, but normally run well below its maximum power. The advantage thus attained in regard to safety is clearly shown in the greatly increased ability to arise out of a confined space, while the reduced normal strain on the engine largely assists in producing a reliable machine.

As regards landing in a confined space, the pilot's view and the controllability of the machine are two very important factors, and there is some tendency to place upon them insufficient weight.

The run on the ground after such landings can be reduced if suitable wheel brakes are fitted, and very promising designs were exhibited by some competitors.

The precautions taken by designers to avoid any risk of fire in the air and largely to reduce the risk of fire in the event of a crash showed that this important point had received due attention, and ideas embodied in competing machines will be of definite value in future designs.

The Amphibians also displayed a marked advance towards safety in another direction. Capable of alighting on and rising from any practicable site on land or water, they have a great advantage over other forms of heavier-than-air craft, while the low position of the hull very largely reduces any risk of injury in the event of a minor accident on the ground.

Aircraft designed for commercial use show a marked advance in comfort over those originally designed for war purposes and afterwards modified to suit civil requirements. Seating accommodation, heating and ventilation arrangements have reached a very fair standard of comfort, but in this respect the question of silencing the engines has not yet had sufficient attention. The design of aircraft as affecting their economical use is of great importance commercially, and in this respect the Competitions brought forward many excellent points in detail design.

The reduction in the number of parts subject to wear, and the increased accessibility of those requiring attention was attained in competing machines to such an extent as to offer a considerable improvement in economy of maintenance.

Commercial Air Lines in Germany

According to the *Handley Page Bulletin* "the Hamburg-Berlin-Nuremberg-Munich daily service which opened recently is now being flown over a distance of 465 miles of German territory, and the Hamburg-Berlin-Breslau line represents a daily flight of 315 miles, the aeroplanes carrying mails to other important cities *en route*. A temporary aviation measure with the Swiss Federal authorities was ratified by the Reichstag at the end of last year, and the German-Swiss aerial connections are flying *via* Lorrach, and also *via* Konstanz. The Berlin-Stettin-Danzig-Koenigsberg line is also a *fait accompli,* and official aviation time-tables for 1921 show that practically every town of importance in Germany will be linked up by the air mails.

"The air services are also being timed to connect with the mail trains to towns off the flying routes, and the motor-cycle is being utilized for the distribution of local mails to outlying places. The daily Press is beating the drum vigorously in the interests of civil aviation, and everything points to the development of the German Air Services in 1921 on a scale which is calculated to surprise even the British Air Ministry.

"The best way of making the new services a paying proposition in the near future has not been lost sight of, and German aeronautical engineers profess to have a monoplane available, capable of carrying 2 cwts. of freight a distance of 315 miles on a total consumption of 12 gallons of fuel. The adoption of a number of these small planes, will, it is said, make civil aviation a paying proposition."

Vienna as Aerial Junction

Recent reports indicate that Vienna has aspirations to make the Austrian capital the dominating center for European aerial travel. As a result of a conference between the Mayor and the Inter-Allied Commission of Control, a commission has been appointed to consider the "creation of a big international base for air travel."

French Government Order 50 Machines

The Liore and Oliver concern are reported to have received an order from the French Government for fifty Breguet machines to be constructed during the coming year. During the past year the firm have been working on a military machine fitted with two 600-h.p. Hispano-Suiza motors, while they have another ready for testing which has three Rhône motors.

35-Hour Endurance Flight Planned

It is reported that a new Farman "Goliath" has been built with a view to making a continuous flight for 35 hours. The present world's duration record stands at 24 hrs. 19 mins. 7 sec., which is held by the above company. It is expected that the pilots will be Bossoutrot and Bernard, who set up the present record.

A New Italian Speed Prize

Sig. Luigi Mapelli, who last year presented prizes for a competition for small machines in Italy, has now offered to the Aero Club of Italy a prize of 50,000 lire for a speed contest. The course will be 150 kiloms. for the first race, and it will be doubled for each of the two succeeding events.

Parachute Jump at 100 Miles an Hour

A message from Nice states that Lieutenant Jean Ors recently jumped from an aeroplane travelling at nearly 100 miles an hour when 1,200 ft. above the sea, opposite the Promenade des Anglais, in order to test a new type of parachute. The test was in every way successful, except that a gust of wind carried the parachute on to the roof of the Palais de la Jetée, where the airman was slightly bruised.

Aviation School for Ecuador

The Ecuadorian Congress during a recent session passed a law providing for the establishment of a school of aviation in Guayaquil and in Quito. The services of foreign experts are to be solicited. and funds are to be raised and appropriated for the maintenance of these schools. The public has contributed a large sum toward the purchase of aeroplanes, and one has already arrived at Quito.

Commercial Aviation in Belgium

A report published in Belgium shows that on the Brussels-London service 130 trips were made between June 19 and September 30; 187 passengers were carried, 1.000 kilogs. of goods and 337 kilogs. of mail matter. On the Brussels-Paris service from June 18 to August 23, 217 trips were made, 164 passengers were carried as well as 675 kilogs. of goods and 95 kilogs. or mails. In the Belgian Congo a service was regularly maintained between Kinshasha and Combe by four waterplanes.

Belgian Subsidies

An aeronautic construction company has been founded in Brussels. The Belgian Government is said to be supporting the scheme with a view to rendering Belgium independent of foreign aerial transport.

Commercial Airship Station

It is rumored that Pulham air station in Norfolk, where two Zeppelins are being overhauled, will be handed over to a commercial syndicate after the Government have used it for six months for experiments.

Aircraft Companies Registered in 1920

According to the list of company registrations for 1920, compiled by Jordan and Sons, Ltd., Chancery Lane, London, twenty-one new aircraft companies, with a total capital of £693,600, were registered. Of these, ten, with a total capital of £529,600, were registered during the first half of the year.

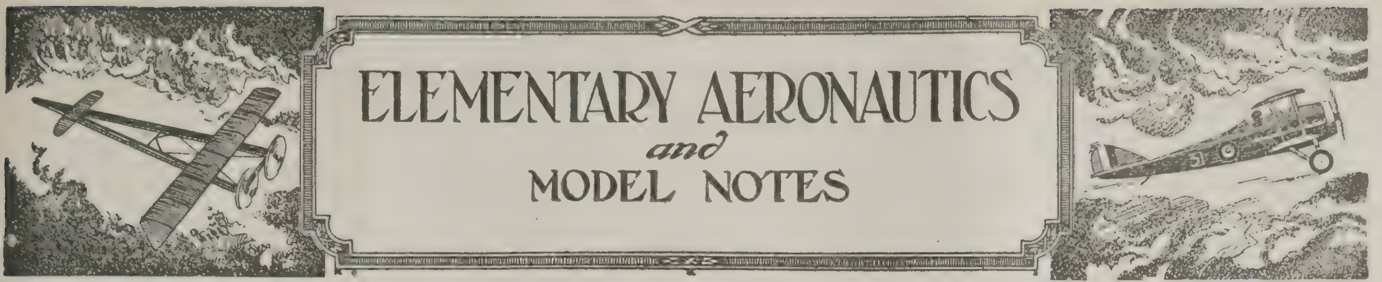
Danish Appropriation

The Danish Budget Committee has granted the necessary one and a half million kroner for the purchase of 320 hectares of land at Kastrup, just south of Copenhagen, for the purpose of constructing a landing place for aeroplanes and hydroplanes.

Dutch Order Seaplanes

The Dutch Navy are making extensive use of seaplanes in the Dutch East Indies, and on the strength of experience with numerous samples of this type of craft, they have entrusted to the firm Van Berkels Patent, Rotterdam, the task of designing and building two-seater reconnaissance seaplanes for use in the tropics. The machines in question are twin float monoplanes, fitted with Rolls-Royce "Eagle 8" commercial type engines. Rigid bracing from the floats to near the center of each half-span is used in conjunction with a thick wing section—*i. e.,* they may be described as semi-cantilever wings. The floats are of the long multistep type, entirely built of duralumin as East Indian experience shows three-ply to be entirely unsatisfactory as a float material. The machines have a top speed of 112 m.p.h. and a full throttle petrol capacity of seven hours' flying. which gives a cruising range of 1,000 miles.

ELEMENTARY AERONAUTICS *and* MODEL NOTES



The "Osprey" Distance Type Model

IN a contest for models having a main wing-surface of not more than 48 square inches, the model outlined below made a flight of 750 feet; duration about 30 seconds. The "Osprey" was designed by Mr. A. O. Heinrich, the well-known pioneer aviator of Long Island. Outlines of the Osprey or fish hawk's wings were followed with the result that the model appears quite bird-like while in flight.

The contest, in which Mr. Heinrich won a silver cup for the best flight, limited the supporting surfaces to 48 square inches for the main wing and half that area for the small wing. All the models entered were therefore on a fair basis. The Osprey's front wing measured only 22 square inches in area, although 24 was allowed. Flights were accurately measured with a 100-foot tape measure.

Both wings are cut from balsa wood, the front one 12⅝″ x 2½″, and the rear, or main wing, 20½″ x 3¼″. The curve has a decreasing camber; on the main wing it is ⅛″, and decreasing to 1/32″ at the tips. At the frame, the wing is ¼″ thick tapering to 1/32″ at the ends. To strengthen the wings against damage in landing, ½″ strips of silk are glued around the leading edge.

The frame is hollow. It is built up of four strips of basswood 28″ long and 1/32″ thick, glued to box section and tapering (in side view) from 13/32″ at the middle to 9/32″ at the ends. The underside is tapered and the top face left flat. Balsa bulkheads or diaphragms ⅛″ thick are spaced 4″ apart in the frame. At the front and rear ends. balsa blocks 1″ long are used to obtain the necessary strength where fittings are attached. A few wraps of silk thread are used to bind the structure at intervals along the frame. Amberoid cement is used throughout.

Main wing dihedral. 3½ degrees; front wing 8 degrees. This is equal to a rise at the tips of 1″ in both cases. In the contest, no incidence was used, but later an angle of 1½ degrees was given to both wings, making the machine climb with greater rapidity.

After sandpapering to a smooth finish. the wings were painted with black water color to imitate feathers. Then a single coat of shellac is applied.

Balsa strips fixed along the frame provide a greater bearing surface where the wings are attached by rubber bands. A balsa fin is fixed at the middle of the main wing. and a thin aluminum fin, mounted on a light strip of bamboo is bound to the front end of the frame by means of silk thread.

The bearing is made of 1/32″ cold-rolled steel, developed from a flat pattern, soldered together. Front hook of 1/32″ steel wire soldered to a clip which is bound to the frame. Rubber tube covers the hooks.

Propeller of white pine; diameter 10″; pitch 12″. It has a uniform blade 1″ wide.

Below is a list of parts accurately weighed in tenths and hundredths of an ounce:

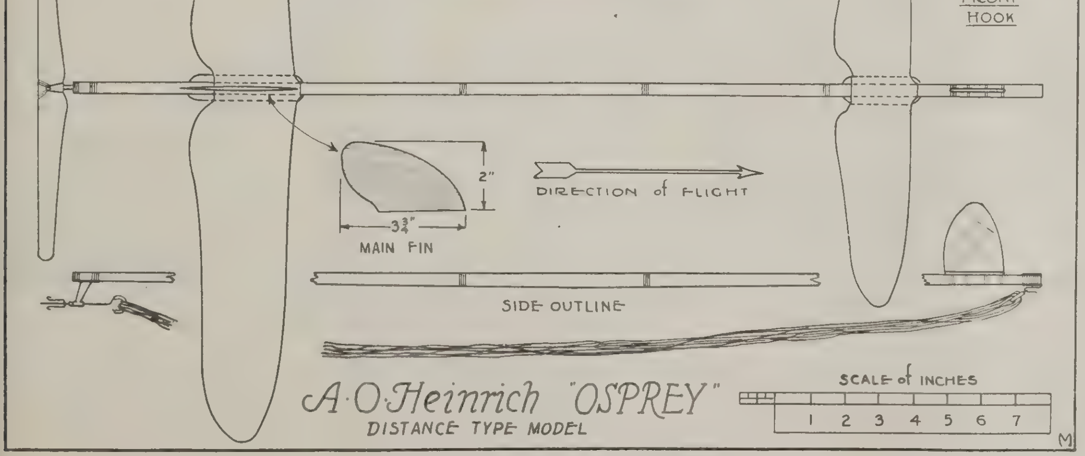
Main wing	.57
Front wing	.24
Frame (all fittings and fin)	.57
Propeller	.14
Rubber Motor (8 strands)	.50
Total flying weight	2.02

Using 8 strands of 1/16″ square rubber, it is possible to give the propeller 700 turns. In ordinary flights, however, about 500 turns are sufficient to fly the model nearly 700 feet. Ten strands of rubber weighing .63 can be used for speed.

A Launching Device for Flying Boat Models

Builders of flying boat models will be interested in the suggestion of Arnold Cister of St. Paul, Minn., who has been experimenting with a noval launching device.

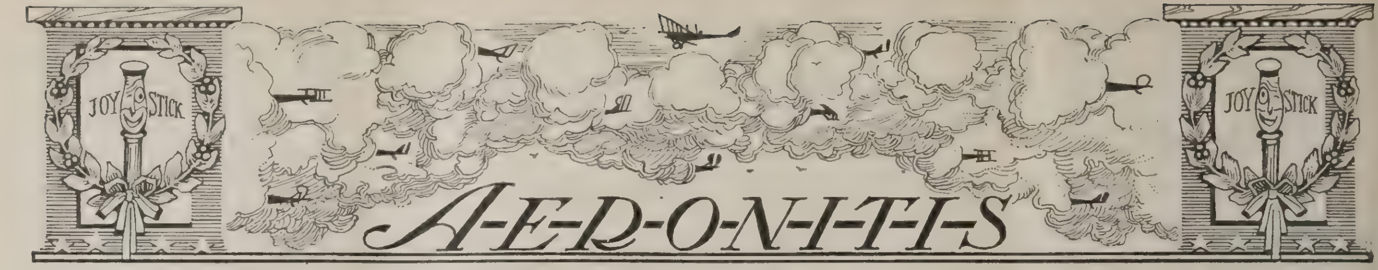
The first step is to secure four 2″ model wheels from which the tires are removed. These are set on a standard gauge toy railroad track, which is secured to an elevated platform. A platform is built over the wheels and upon it is placed four or five cradles or pieces of wood formed to fit the body. A piece of cord is tied to the truck so that when it runs down the track it will come to a halt suddenly while the plane skims over the water. It will be necessary to regulate the cord to the correct length and to make sure it is made fast or the strain is liable to cause the truck to trip.



In preparing to launch, the runway is placed on the shore with the model set in the cradles. When the propellers are released the truck will run along the track at a speed sufficient to give the machine a good start in the air and it will skim the surface of the water until it takes the air on its wings.

A device of this kind is especially good for a heavy model because so much power is required in the initial plowing through the water that very often the power is expended before sufficient velocity has been obtained for flight, but with the device mentioned the preliminary force required for a flight is not more than that required for a land machine.

Mr. Cister is engaged in constructing a model of the NC-4 for which the he will use the runway described.



A-E-R-O-N-I-T-I-S

Lost

First Pilot—What's the matter, Jones?

Second Pilot (who is searching for his wife whom he left near the hangars)—I've lost my wife!

First Pilot—Too bad. When is the funeral?

H. J. J.

"To make a long story short——" continued the aviation story telling bore.

"Well, why don't you?" snarled Lieut. Rufus Rasp, R. F. C.

G. W. H.

A Honeymoon by Aeroplane

When the moon shines on the aerodrome,
And there's nobody to be seen in sight,
I'll have my ship awaiting there already for a flight.
So get prepared, my little dear, to go into the air.
Away up high into the sky we'll fly and fly and fly.

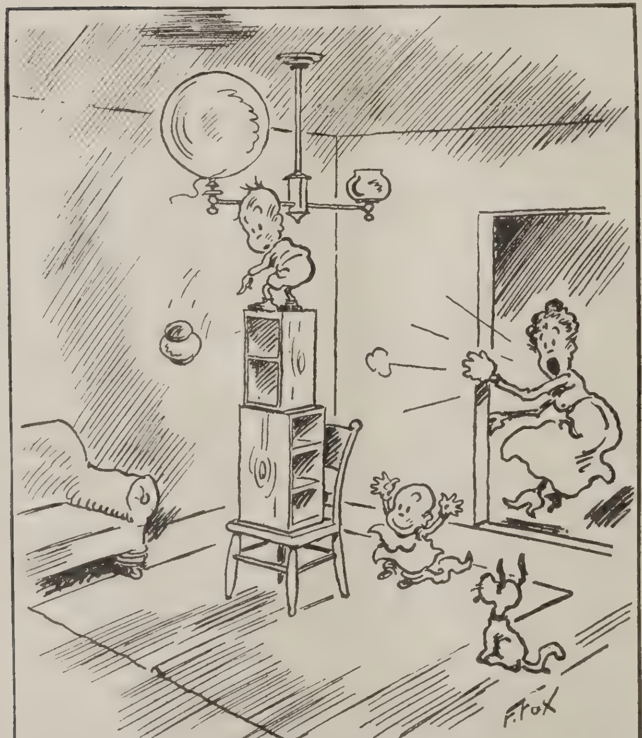
We'll fly from beach to beach;
We'll fly from coast to coast;
We'll fly from continent to continent,
And that's about the most.
The cost will be abundant,
But the trip will be its worth,
With the airship's wings a-shining,
And a gliding o'er the earth.

A Rendezvous

Up at the break of the dawning,
  Up in the crystal air,
Just as the gloom is fading,
  Stillness everywhere.
Life through your brain a-surging,
  Loudly the engines roar,
The earth below fast fading
  As heavenward you soar.

Up till you greet the dawning,
  Banded the earth in grey,
The sun through the mists fast climbing,
  Harbinger of day.
Up through the misty dawning,
  Stifle the motor's drone,
Meeting your dawn in the heavens
  Up there in the sky—alone.

V. J. O., Jr.



Elementary Aerostatics

The Lament of a "Bap."

We all love a jolly good rollicking time;
But how can one have it—quit at five, begin at nine;
Mondays, Tuesdays and Wednesdays the same,
Thursdays, Fridays and Saturdays—gee, but it's tame.
What do we need of new suits, shoes or new hats,
We who strive for the good of the B. A. P.—BAP.
A wonderful office if for joy you've no taste,
But not for the youthful lover of outdoors and space—
Just harken to this—the tale of our woes,
'Twill cause you to quake from your crown to your toes.

Imagine, if you can, your automobile
In perfect condition except for one wheel;
Imagine a horse that's built for a race,
Gone lame and blind, no hair on its face;
Imagine yourself gotten up in your best,
And no place to go when once you are dressed;
Imagine a cozy swing, soft breezes, a moon,
And no cuddling mortal with whom you can spoon;
Imagine "ad lib"—the worst is too fine:
To a dull office when it's out-doorsing time.

E. B. W.

Cheered Him Up

After much meditation the wealthy business man thought he would go a-flying. So he approached an aviator at a flying ground and fixed things up.

Up they went, but the machine seemed very unsteady. It wobbled and zigzagged terribly, and once or twice nearly sideslipped.

"Easy there!" gasped the passenger, roaring wildly above the noise of the engine. "Remember this is my first trip."

The aviator yelled back at him: "Well, it's only my third."

Military Information

Miss Quizitor—Oh, Mr. Winger, why do you carry those awful bombs when you fly?

Lieutenant Winger (*of the Aviation Corps*)—You see, when I'm surrounded by clouds I need them to blow an opening in the silver linings.

What He Expected to Be Asked For

Officer (while examining applicant for Fort Snelling)—Got any scars on you?

Applicant—No, but I got some cigarettes over there in my coat.

Close to Earth

I never yet have ridden in aeroplane or balloon, although I've oft been bidden to board one and go skiddin' around the smiling moon. In motor cars I've gadded, but I'm not keen to fly; until the earth is padded, with velvet cushions added, I will not soar on high. I note the plane and scan it, but if I fell from that, the jolt would shock the planet, and all the folks who man it, and leave the buildings flat. I hold it right and proper for youths to tour the air; for they're as tough as copper, and if they come a cropper they do not need to care. But my old blood is chilly, I limp in many styles; and I'd look rather silly if I fell, willy-nilly, about a dozen miles. My years are three score seven, and I'd lose dignity, if I came down from heaven, some fourteen leagues or 'leven, and landed in a tree. I hear the air fans calling, "Come with us, if you please!" The sport is too appalling for one whose beard is falling, all snowy, to his knees. Let reckless youth unravel the cloudland's mystery; the soil on which I travel, the unupholstered gravel, is good enough for me.

WALT MASON.

29.105
AER Engineering

AERIAL AGE WEEKLY

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General Mitchell on Aviation

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VICKERS
LIMITED

**Aeroplanes for Commercial and Military Use. Vickers-Saunders Flying-Boats.
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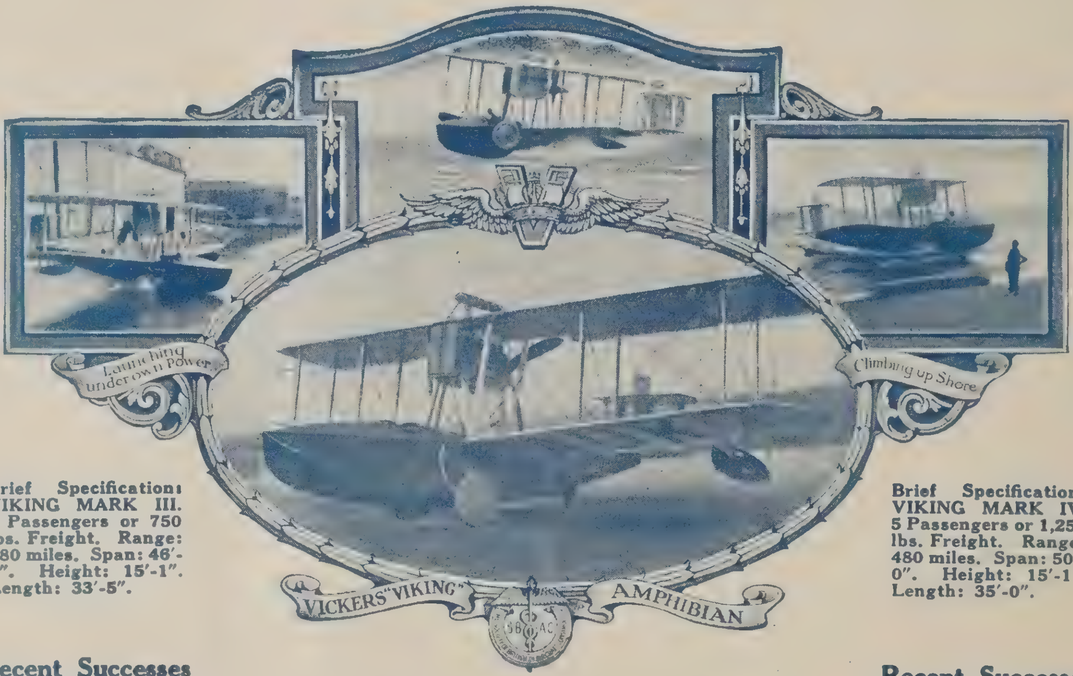

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Brief Specification: VIKING MARK IV. 5 Passengers or 1,250 lbs. Freight. Range: 480 miles. Span: 50′-0″. Height: 15′-1″. Length: 35′-0″.

Recent Successes

The Vickers "Viking" was classified FIRST in the following competitions at the INTERNATIONAL SEAPLANE COMPETITIONS at ANTWERP, July, 1920.

1. Shortest time in "unsticking" from water.
2. Fastest time over a given circuit.
3. Climb to 1,000 metres.
4. Altitude with full load.

Aviation Department
VICKERS HOUSE,
BROADWAY, LONDON, S.W. 1.

Recent Successes

The Vickers "Viking" was the winner of the FIRST prize of £10,000 for the Amphibian Class of Aircraft entered for the BRITISH AIR MINISTRY COMPETITION. September, 1920.

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AUTHORITY

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GENERAL MITCHELL ON AVIATION

GENERAL MITCHELL is to be commended for his frank and fearless testimony as to the importance of aviation in future warfare. He may have erred in some of his statements and he may have exaggerated the dangers to which a surface fleet will be subjected by air attack.

Secretary Daniels' comments upon General Mitchell's testimony were undignified and gratuitously offensive to that officer. The General had a perfect right to express his personal opinion that an air force would drive dreadnoughts from the sea and would provide a surer and much more economical defense for our coasts than the expensive forts and big guns upon which we now rely.

If the General is wrong the fact can be demonstrated in a searching and dignified investigation by Congress. The people of this country, who are to foot the bills, wish to know the truth and the whole truth before they spend more billions. Mr. Daniels and the few naval officers whose minds go along with his should not be permitted to stifle discussion and to dictate the decision as to our naval policy in the last thirty-four days of his disastrous administration.

In truth, the country owes General Mitchell a vote of thanks. Inasmuch as admirals and naval officers of independence are not permitted to speak, it is most fortunate that a general of the Army has torn off the lid. We may hope that Mr. Baker will not meekly submit to a Kaiserlike attempt by Mr. Daniels to throttle Army officers as well as admirals—who "cannot say that two and two make four"!—*Editorial in N. Y. Tribune.*

Preparedness in the Air

A BUSINESS man who has insured his factory for many years does not complain that he has paid premiums for nothing because there has been no destructive fire in his building; nor, if he is a practical man, does he consider insuring his property for $10,000 when it is worth ten times as much. Congress does not look at insurance of the country against the waste of war as sensibly. Constantly are heard complaints that too much money has been spent upon the Army and Navy for national defense, and when appropriations are wanted to equip a branch of the military service adequately a half or a third is allowed, no matter how good a case is made out for more. Thus the country carries less insurance than it should have, which is bad business.

The House Committee on Appropriations has recommended that $19,200,000 be allowed for Army aviation, although Brig.-Gen. William Mitchell, Assistant Chief of the Army Air Service, had asked for $60,000,000, of which $17,000,000 was to be spent to equip units with modern aeroplanes. "Those we have now," he told the House Military Affairs Committee on January 4th, "are obsolete, old and becoming unsafe." There was such wastage during the war in building American aeroplanes on a colossal plan which proved to be a shocking failure that Congress is suspicious when the development of the air service of the Army or Navy on a modest scale is urged now. And members of Congress, of whom drastic economy in most things is expected, are prone to cut down every estimate asked for with small regard for the need of the appropriation. Even when there is crying need for money for the upkeep of an established and meritorious institution the knife goes through the estimate just the same, often leaving it a remnant. If the appropriation wanted is for national defense, the danger of another war is declared to be remote. Little attention is given to the wisdom of full insurance.

House committees may not accept General Mitchell as the most eminent authority on military aviation, and they may be disposed to turn to others for information about naval aeronautics, but in his appearances before the Military Affairs Committee early in January and the Appropriations Committee last week he surely qualified as an expert both at the front in France and since the war as Assistant Chief of the Army Air Service. What General Mitchell told the committees about the offensive and defensive power of the aeroplane on sea or land was not new, although more than one Representative seemed to hear it for the first time. Unfortunately there are few members of Congress who make a study of war inventions and preparedness. At the hearing early in January General Mitchell stated that the French were maintaining a force of 3,000 land planes, and that the British, besides keeping up a formidable army flying corps, were acquiring ocean aircraft carriers and developing machines to fight above the water, while the United States lagged behind in aviation. The committees he addressed listened to illustrations of war in the air with wonder or incredulity. How great cities might be gassed from the sky by planes brought to the coast on aircraft carriers, unless there should be a defensive force to drive the enemy off, should have made a profound impression in the telling.

All the horrors described by General Mitchell, America may experience if other wars are to be waged and preparedness has been neglected. He pleaded with his hearers for a demonstration of what bombing planes could accomplish in attack upon an obsolete war vessel selected for experiment. That may be the business of the Navy, but certainly one of the old battleships of the Spanish War could be spared for a thorough test. And other demonstrations of the destructiveness of bombs dropped from the air would be educational. If Congress can be made to understand the offensive power of aircraft on land and sea, adequate appropriations may not come so hard.—*Editorial in N. Y. Times.*

THE NEWS OF THE WEEK

Mimic Air Raid on New York

A slight indication of what could be accomplished by an enemy air raid on New York was briefly demonstrated on February 4th, when a squadron of 15 DH4's flew over the city and dropped "smoke" bombs. The "attack" was organized by the War Department, with a view to attracting public attention to the possibilities of air raids and at the same time bringing home General Mitchell's recent contention that we are lacking in the proper means of protecting ourselves against aerial attacks.

Major Thomas G. Lamphier was in command of the squadron and the machines maneuvered around in splendid formation, dropping from time to time their smoke bombs, which quickly burst into dense clouds of smoke.

Unfortunately, one of the bombs prematurely exploded in the machine in which Lieut. Edward C. Black was observing, and this officer was rather severely burned about the hands and face. Part of the cockpit caught fire and for a few seconds Lieut. Black had an exciting time. With the aid of a fire extinguisher, however, he quickly succeeded in overcoming the flames and the machine landed safely at its home station, Mineola, ten minutes later, without further mishap.

400-Mile Air Race

Secretary George Harrison, of the Aero Club of Southern California, has announced that a 400-mile cross-country air race from Los Angeles to Sacramento will be held on Washington's Birthday, February 22. Cash prizes amounting to $1,000, in addition to the Albert H. Hayes trophy, will be offered the various pilots entered. The race will be a free-for-all event. No entries have been received as yet.

Plan Aviation Meet for Hartford

Hartford will be the scene of an aviation meet next June, according to plans made by the Aero Club of Hartford and discussed at a dinner recently at the City Club. Hiram Percy Maxim, president of the club and chairman of the commission in charge of the project for a municipal field, said that it will be only a matter of days, or a few weeks, before the city has an adequate landing place. He added that an aviation meet in the summer will add greatly to the interest in aviation here.

Major Reed G. Landis, second among American aces and one of the fliers comprising the small group who won international recognition for his work in the war, took sharp issue with statements made by Secretary of the Navy Daniels that battleships are not vulnerable to attack from the air, and said that General Mitchell, who was critized by Daniels, has based his assertions, which caused a stir in Washington within the last few days, on absolute knowledge gained from active service.

America to Get Italian Airship Roma

Italy's giant airship Roma, described in detail in AERIAL AGE recently, is to be purchased by the War Department. The cost to the American Government is 4,000,000 lire. She is to be shipped by steamer and reassembled in this country early in the Spring.

Though built on the broad lines of the typical Italian airship, being semi-rigid, she carries something new. Her cabin for sixty passengers isn't fixed to the envelope by cords and cables, but is part and parcel of the airship itself, built right into her keel. Her makers say this makes for greater safety and is more comfortable for passengers prone to sea-sickness.

The *Roma* is 125 yards long and carries 34,000 cubic yards of gas. The motors are fixed sideways, like the fins of a fish; she has six groups of propellers, three at each side, and 2,500 horse power. She navigates at the rate of fifty to sixty miles an hour, with flying power, without stopping, of 3,125 miles, and can transport 100 passengers very comfortably.

Aviation Country Club of Detroit Affiliates With Aero Club

Colonel H. W. Alden, president of the Aviation Country Club of Detroit presented a formal application for affiliation with the Aero Club of America to the Board of Governors of the Aero Club at a recent meeting, when it was accepted into affiliation.

Navy May Get Its Own Aeronautics Bureau

The creation of a separate bureau of aeronautics in the Navy Department has been approved by the House Naval Affairs Committee. In a bill supplementary to the naval appropriations bill now before the House the committee also recommended appropriations of about $9,000,000 for additional aircraft construction during the next fiscal year. This is in addition to the $20,000,000 carried in the appropriation bill for the normal expenses of naval aviation.

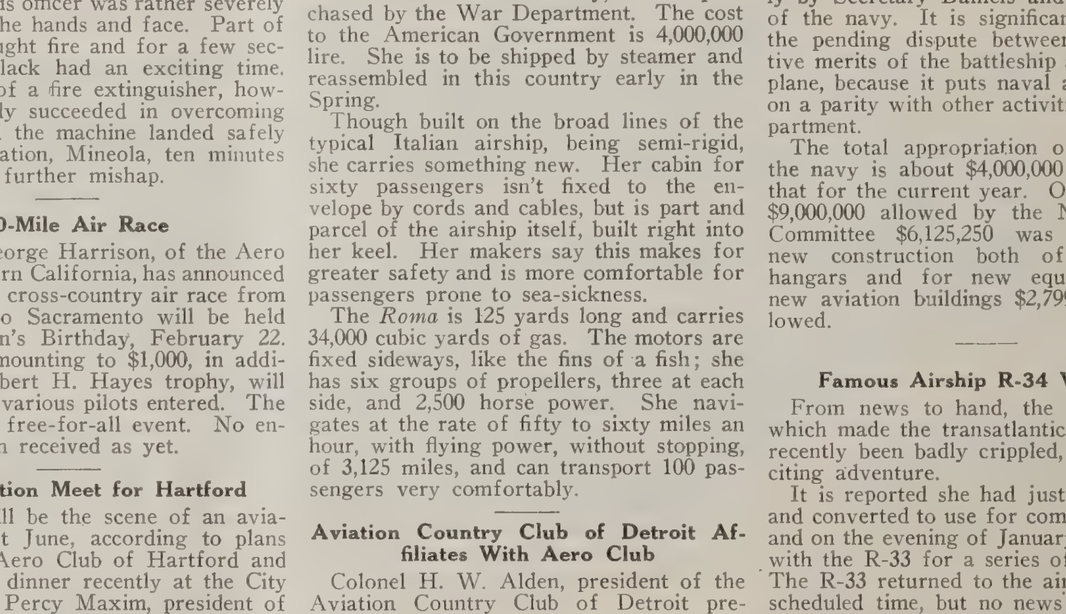
The action in creating a separate aeronautical bureau was recommended strongly by Secretary Daniels and high officers of the navy. It is significant in view of the pending dispute between the respective merits of the battleship and the aeroplane, because it puts naval aviation work on a parity with other activities of the department.

The total appropriation of aviation in the navy is about $4,000,000 in excess of that for the current year. Of the total of $9,000,000 allowed by the Naval Affairs Committee $6,125,250 was allotted for new construction both of planes and hangars and for new equipment. For new aviation buildings $2,799,000 was allowed.

Famous Airship R-34 Wrecked

From news to hand, the airship R-34, which made the transatlantic journey, has recently been badly crippled, after an exciting adventure.

It is reported she had just been refitted and converted to use for commercial flying and on the evening of January 27 went out with the R-33 for a series of manoeuvres. The R-33 returned to the airdrome at the scheduled time, but no news came of the



Airscape of Grant's Tomb, New York City

R-34. Signals were sent up and wireless communication opened, and word was then received that she had bumped into the land, damaged two engines and was drifting astern toward the sea. It is believed she collided with a hill. A strong wind was against her, and this added to her peril. In that neighborhood in the early morning the wind had a speed of 40 miles an hour. The big airship drifted out over the North Sea east of Spurn Head, and before the engineers could temporarily rectify the damage and enable the vessel to make any headway she was fifteen to twenty miles out at sea. She slowly battled her way inland and reached Howden in Yorkshire at 4.30, with only two propellers working, after her unexpected voyage of nearly twenty-four hours. Her front car was said to be badly damaged and the fore-and-aft propellers broken.

Just as the airship was nearing her shed with more than a thousand persons tugging at her ropes a gust of wind caused the fore cabin to bump against the ground. Those of the crew who were in the cabin jumped clear before the impact. After striking the ground the airship rebounded and bumped a second time, more heavily than before. The fore cabin was smashed and the structure above was badly damaged. Fortunately no one was reported hurt.

Later news has come to hand that the R-34 is now a total wreck. It appears the dirigible was forced to remain in the open all night, on the aerodrome at Howden, and the strong wind has completed her destruction.

International Balloon Race

The International Balloon Race for 1921 will be held in Belgium, commencing September 17th. American entries should be filed with the Secretary of the Aero Club of America not later than April 1st.

Flying Popular at Palm Beach

Palm Beach, Fla., Jan. 29.—Flying is more popular here this season than ever before. The Aero Limited has established a daily service making short fights over Palm Beach or to the other Florida resorts. Early in the week Messrs. J. N. McEarchern, Jr., and W. T. Winder flew over from Havana in five and a half hours, a distance of 280 miles and this allowed for a stop in Miami and Key West.

Frank Mills, an instructor in the United States Flying Service, also is here with the hydroplane 333, and he also has instituted a series of daily flights.

Mr. Andre P. Pillot of New York, who joined Mr. George A. Ellis, Jr., at the Everglades Club for a few days, made the trip from New York in a Curtiss Seagull flying boat, having made stops at the Carolinas for duck shooting.

Son of President Plans to Fly Here From Peru

Ancon, Peru, Jan. 28.—Juan Leguia, son of President Leguia of Peru, announced here today he had completed arrangements for an aeroplane flight from Callao to New York City. He has been in Central America for some time, and says he will make stops at Guayaquil, Buenaventura, Panama, Havana and two United States ports. He is chief of the school of aviation which has been inaugurated here by the President.

Two-Weeks' Kiln Drying Course

The February course in practical kiln drying given by the Forest Products Laboratory, Madison, Wisconsin, will be held from February 14-25.

This course will be conducted much like the preceding ones, which have proved more popular than was anticipated. Manufacturers have come from all over the United States, and even Canada, to attend these courses. Mills and factories using yellow pine, redwood, Douglas fir, white pine, as well as all kinds of hardwoods have sent their representatives to Madison for two weeks to learn more of the art of kiln drying lumber so as to cut down present losses in seasoning, both outdoors and in the kiln. The present slack business conditions make it particularly convenient for foremen and higher executives to get away from their plants.

The instruction in these courses is not confined to any particular kind of lumber or type of kiln, although methods of drying different species of lumber and the operation of various types of kilns are discussed. Emphasis is laid on the underlying principles of successful kiln drying; and these can be adapted to any conditions. The following are some of the subjects covered: testing lumber while drying; methods of preventing checking, casehardening, warping, and collapse; regulation of temperature, humidity, and circulation in the kiln; advantages and disadvantages of different types of kilns and kiln equipment; identification of lumber; your own problems in kiln drying.

A co-operative fee of $150 per person is charged to pay the expenses of conducting this course.

$25 Fine for Low Flying

Pasadena.—The first prosecution ever made under Pasadena's air traffic ordinance came recently. It was an aftermath of the New Year's fete here. C. K. Wollam of Los Angeles, pilot of a pony blimp which sailed over Tournament Park during the Ohio-California football game, was fined $25 in police court for coming below the 1000-foot level while over the park.

Yolo Fliers Club to Hold Meet

The Yolo Fliers Club of Woodland, Cal., will hold an aerial meet on May 7th, when it is expected that there will be a large representation of Army flyers from Mather Field. Manager O. W. H. Pratt of the Club has the arrangements well in hand.

Remarkable Airscape of Venice, Italy

The AIRCRAFT TRADE REVIEW

New 1,000 Horse Power Aero Engine

London.—According to *The Evening News,* a powerful new Napier aero engine, called "The Cub," which, it is claimed, will revolutionize air travel, has undergone successful tests. It is an 18-cylinder engine of 1,000 horsepower, and is intended for use by the Royal Air Force.

On its test the engine gave 1,057 horsepower and was run for twenty hours. It weights just under a ton and cost about £5,000. It is understood that two "Cubs" are to be fitted to the Titania, a large flying boat which is being built by the Fairey Aviation Company. The Titania, says *The Evening News,* will have a range of about 1,500 miles, and in wartime would carry crews of about ten. If adopted to civil use it probably could accommodate fifty people.

The paper declares that the advent of "The Cub" engine opens up possibilities of regular daily transatlantic service with giant flying boats of 5,000 horsepower, carrying 250 passengers.

William B. Crisp Dies in New York

William Benton Crisp, well-known patent attorney, and general counsel and trustee for the Manufacturers' Aircraft Association, died at his New York city home on January 28th.

Mr. Crisp was born near Baltimore and studied at Johns Hopkins University, completing his law training at Columbia University.

For six years Mr. Crisp was a member of the law committee of Tammany Hall. He was a member of the Lawyers, Lotos, Greenwich Golf and Aero Clubs, the Maryland Society and the Beta Theta Pi and Phi Delta Phi fraternities. He leaves a widow and two sons, Theodore M. and J. Van de Vanter.

Big Passenger List of Blue Bird Airlines

The Blue Bird Airlines Co. of Los Angeles, Cal., report over 2,400 passengers carried in southern California during the past four months. Aeroplanes of this company have operated in the following cities during the above-named period: Ontario, Pomona, San Bernardino, Redlands, Corona, Santa Ana, Torrence, San Fernando, Victorville, Needles, Kelso, and Kingman, Arizona.

The Blue Bird Airlines, Incorporated, has recently taken over the equipment of the Blue Birds Co. The first big project of the company is the organization and operation of an airline from Los Angeles into the Big Bear Lake section, east of San Bernardino. The company expects to be operating seven-passenger planes on this run by the first of May.

The officers of the recently organized corporation are: D. D. France, President; E. H. Barrett, Secretary; N. H. Langley, Vice-President; John D. Montijo, Treasurer and General Manager, and Frank B. Tomick, Director.

Secretary Barrett, speaking of the proposed route, says: "There are unlimited possibilities for commercial aviation in southern California. The whole world is familiar with the fact that the most varied and scenic section in the world is in southern California.

"The Big Bear section in the San Bernardino mountains has a vast variety of attractions which beckon to lovers of nature and the outdoors with irresistible appeal. Many of the big outdoor scenes in the movies are made in this section, one of the notable ones being the outdoor scenes in Sir Oliver Curwood's 'The River's End.'"

$5,000,000 Put in Helium Plant

Forth Worth, Tex.—Finishing touches are being put on the Federal Government's $5,000,000 helium gas plant six miles north of Forth Worth, and operations on a large scale are expected to begin soon.

This announcement is made by Lieutenant Griffin, who is in charge, as the representative of the Navy Department. The last of the machinery was shipped to Fort Worth before the first of the year.

Established in 1917, at a cost of $800,000, the plant has been an experiment station thus far. But the worth of the gas and its economy for use by the Navy and Army balloons have been proved to the satisfaction of military experts.

In addition to the plant near Fort Worth, the Government also has constructed a private pipe line from Petrolia, which brings natural gas from the Lone Star Company's wells right into the plant. After the argon qualities, from which helium is obtained, have been extracted, the gas is returned to the mains and burned by Forth Worth and other consumers in northern Texas.

The argon helium plant was erected in great secrecy, a guard of soldiers being constantly maintained around it until after the armistice. During war days admission was denied to the public and only picked workmen were employed.

The experiments at the station had been so successful before the armistice that it was predicted the use of the argon gas would speedily terminate the conflict. However, no opportunity was ever given of testing it out in battle.

The gas is non-inflammable and noncombustible. Its value was discovered before the war, but the process of extracting it was then too costly to make the gas practical. Government agents have since perfected an economical method.

The gas is shipped from Fort Worth to Galveston and New Orleans in cylinders and loaded there aboard Navy Department vessels for transportation to balloon fields.

The Wright Patents in France

The owners of the French Wright Patents have obtained from the Courts a writ of attachment on some 3,000,000 francs, owing by the Ministers of Finance to one of the French Constructors. The writ has since been modified as regards 300,000 francs of the total which the firm requires immediately for development purposes.

British Flying Field in Texas to Be Sold

Fort Worth, Texas, Jan. 29.—After many complications and delays the sale of Taliaferro Aviation Field here on Feb. 23 was formally ordered today. This air field was established by the Royal Flying Corps of Great Britain in 1917 for the training of Canadian aviators and was afterward taken over by the United States government.

Duesenberg Sues on War Work

New York, Jan. 24.—The Duesenberg Motors Corp., one of the Willys subsidiaries, has sued the Government to recover $1,201,851 on contracts for the manufacture of Liberty motors.

Aero Import Moves to New Quarters

The Aero Import Corporation, formerly located at 118 William Street, New York City, has moved its offices to the Gotham Bank Building, 1819 Broadway, New York City.

Captain Archibald Johnston has been appointed Sales Manager of the Company. He was formerly a member of the Lafayette Escadrille and served from January 1918 to January 1919 as chief Instructor at Gerstner, Carlstrom and Dorr Fields.

This corporation will, at its new address and its hangars at Hazelhurst Field, continue to import and sell Ansaldo aeroplanes. The 1921 models include single seaters, two-seaters and three-seaters, as well as the six place aerial transport limousine which has lately aroused favorable comment in the trade press.

Keystone Airline

The Keystone Airline Corp. has been organized for the purpose of operating an aerial route between Pittsburgh and New York. The company now operates JN-4D's for local work.

Offices of the company are located at Greensburg, Pa., and Latrobe, Pa.

The officers of the company are: Chas. F. Hissem, of Greensburg, President; Roy Windell, of Connellsville, Pa., Treasurer and Manager; B. R. Gaines, of Greensburg, Pa., S. P. Levoy, of Latrobe, Pa., and C. M. Chorpening, of Connellsville, Pa., directors.

Aerodrome for Calgary

Calgary.—According to a communication received by Mayor Marshall from Mayor Croil of the Air Board, the latter has been unable to secure a suitable aerodrome site in Calgary at anything like the figure that the board were prepared to pay, which was $70 an acre, and that this being so there was a possibility that Calgary might lose the aerodrome. It was pointed out that while in the initial stage of the scheme the project might not be very imposing, there was every likelihood that in the future it might be greatly developed. The mayor stated that if land could not be obtained at the price the board was prepared to pay, that the aerodrome would possibly be built at Red Deer. About 100 acres would be required.

Personal Pars

H. K. Maxwell, formerly with the Bishop-Barker Company, has joined the Air Service Corps at Springfield, Mass., and expects to go to Texas shortly.

INSTRUMENT FOR MEASURING ENGINE CLEARANCE VOLUMES

By S. W. SPARROW

Automotive Power Plants Section, Bureau of Standards

THE following Technical Note on an Instrument for Measuring Engine Clearance Volumes was designed and constructed under the direction of the Automotive Power Plants Section of the Bureau of Standards, and submitted for publication through the Subcommittee on Power Plants for Aircraft of the National Advisory Committee for Aeronautics.

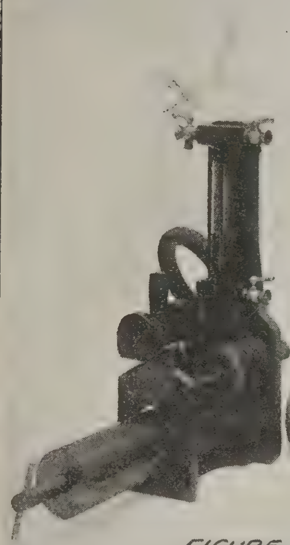


FIGURE 1.

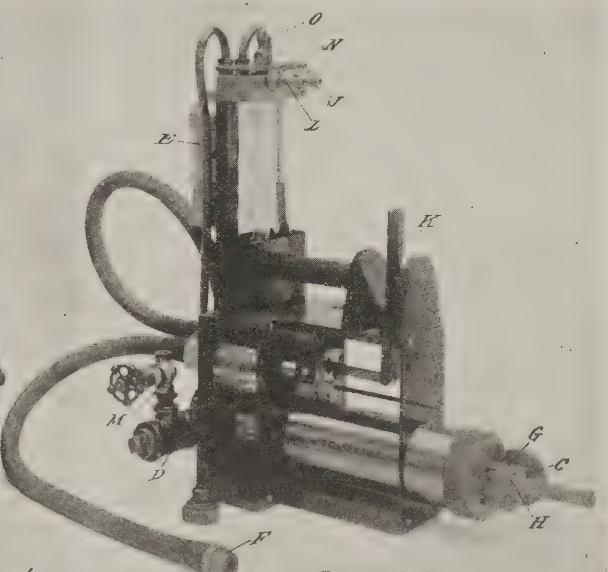


FIGURE 2.

A few years ago, when the gasoline engine with vertical cylinders was the well-nigh universal type, a description of apparatus to measure clearance volume would have aroused little interest. In the highest part of such cylinders there was usually located either a valve or a spark plug through the opening for which liquid could be poured. The volume of liquid required to fill completely the combustion space with the piston at upper dead center served as the clearance measurement. To be sure, it was a rather messy procedure, requiring considerable time to remove the liquid when check readings were desired, but otherwise was fairly satisfactory. With the advent of the V type engine, the problem ceased to be simple. Frequently it was almost impossible to make this measurement with the engine mounted for test, as all openings were then below the highest point in the cylinder.

In the summer of 1919 Major Norman of the English Royal Aircraft Establishment at Farnborough suggested making this measurement by a process which consisted essentially by simultaneously changing both a known and an unknown volume of gas by a known amount and then calculating the magnitude of the unknown from the resulting difference in pressure between the two. To Dr. Dickinson, who was in Europe studying aviation development, the idea made instant appeal and on his return to the Bureau of Standards he started the construction of an instrument based on this principle. In the first instrument, Fig. 1, no attempt was made at refinement in constructional details, as it was believed that, once the instrument was proved practical, its use would suggest such changes as would make for greater accuracy and convenience of operation. In the development of the present design, Fig. 2, Mr. C. W. Elliot has incorporated many such changes, but in all major features the instrument is the same as the original built by Mr. A. R. Long, to whom much of the credit for its success is due.

The principle of the apparatus is shown in Fig. 4. If the volumes A and B are each decreased the same amount by the movement of the pistons, there will be a pressure increase in each cylinder, the greater increase occurring in the smaller volume. The pressure difference will be indicated by the difference in liquid level in the U tube connecting the two cylinders. In practice, Volume a, the clearance volume, is always unknown, while the other, Volume b, can be altered by moving piston c, Fig. 5, in or out of the measuring cylinder and its magnitude read from the scale on the piston stem. This calibrated volume is changed until the movement of the two companion pistons produces the same pressure increase in both cylinders as indicated by the liquid in the U tube remaining level. Both volumes are then equal. The above statements hold true only if both cylinders are airtight or if both leak at the same rate. Since the engine cylinder is never strictly tight, an adjustable opening is provided to permit an equal rate of leakage from the comparison cylinder. For clearance, the simultaneous volume changes are described as taking place in the clearance and measuring volumes, whereas actually there are auxiliary volumes d_1 and d_2, connected with these in which the actual change is made, so that it is (clearance volume +

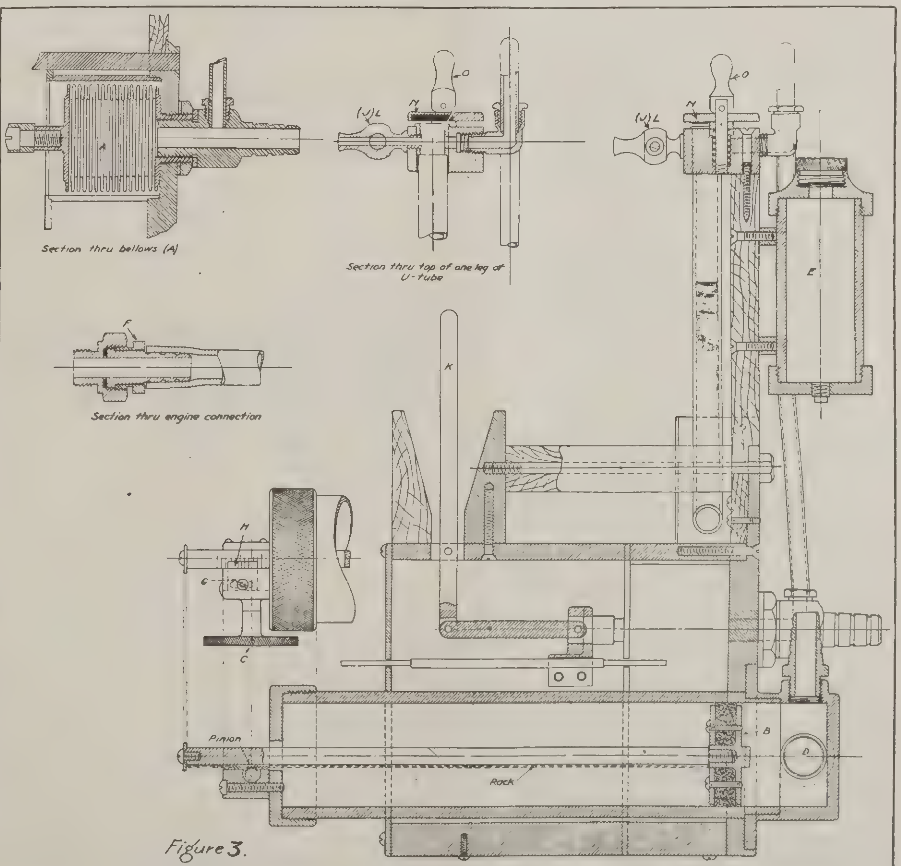

A
Section thru bellows (A)
O
N
(J)L
Section thru top of one leg of U-tube
F
Section thru engine connection
K
E
H
G
C
Pinion
Rack
B
D

Figure 3.

auxiliary volume d_1) and (measuring volume + auxiliary volume d_2) that are changed. The addition of these auxiliary volumes simplifies the apparatus for making the volume changes and, inasmuch as both are equal, does not alter the relations described above.

The actual instrument is shown in diagram in Fig. 6, in section in Fig. 3, and in the photograph, Fig. 2. For producing the changes in volumes the pistons, shown in the schematic drawing, have been replaced by the cylindrical copper bellows A. Changes in the comparison volume are produced by turning hand wheel C, the motion being transmitted to the piston B through a gear and rack. A vernier and graduated scale on the piston stem permit the direct reading of volumes up to 48 cubic inches in steps of one-tenth of a cubic inch. Should it ever be necessary to measure larger volumes, an auxiliary cylinder can be connected to Tee, D, now closed by a pipe plug. The measurement would then be made as before except that to the reading on the piston stem should be added the volume of the auxiliary cylinder. Tank E is a check volume of 7 cubic inches, used only for calibration purposes. When the tubing is renewed, fitting F is screwed into the tank, screw G loosened, and vernier H adjusted to read exactly 7.

Measuring clearances volumes consists of three distinct steps:

1. Measuring the rate of leakage from the engine cylinder.
2. Making the rate of leakage from the comparison volume equal to that from the engine cylinder.
3. Equalizing the comparison volume with the clearance volume.

In measuring the rate of leakage from the engine cylinder, after having latched cover plate N, needle valve J is opened, leaving the right side of the U tube open to the atmosphere. Lever K is then pulled back until a considerable pressure difference is produced. The leakage rate is estimated by noting the approximate time required for the pressure to decrease a definite amount. Valve L is next opened and J closed, one side of the U tube now being open to the atmosphere and the other connected to the comparison volume. Valve M is then adjusted until the leakage rate is approximately the same as that from the engine cylinder.

In equalizing the volumes, valves J and L are both closed, the left leg of the U tube then being connected to the engine cylinder and the right leg to the measuring cylinder. When changing the volumes by means of lever K, it is most convenient to watch but one leg of the tube. If the left leg be the one chosen and the initial movement of the liquid is downward, it indicates the pressure in the engine cylinder to be the greater and its volume to be the smaller. After relieving the pressure on both sides by raising cover plate N, the volume in the measuring cylinder should be decreased. The cover plate is again lowered and secured tightly with latch O and the process repeated. The correct volume is that with which there is no change in liquid level noted at the first application of the pressure.

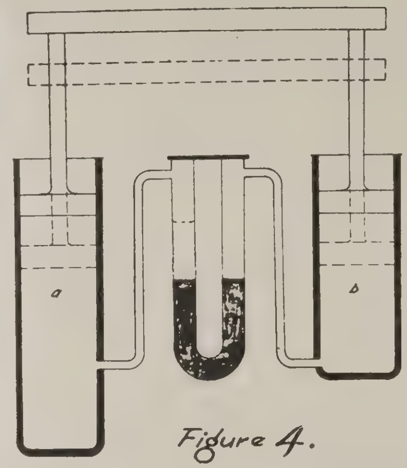


Figure 4.

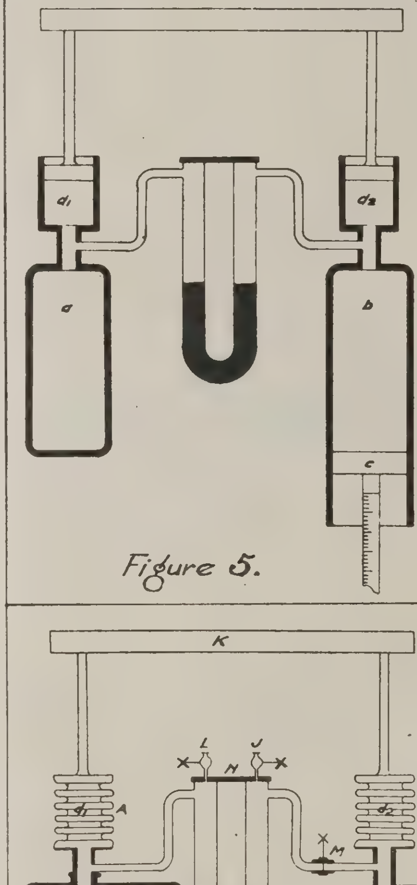


Figure 5.

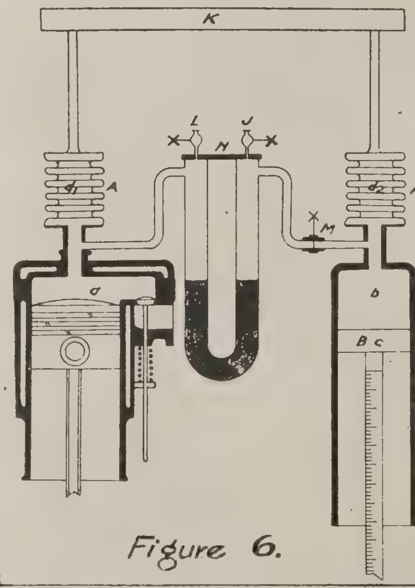


Figure 6.

It will frequently be found that with the volumes well equalized, after the pressure has been maintained for a second or two, the deflection of the liquid in the U tube will increase, showing that the leakage rates have not been perfectly balanced. A few trials will readily convince the operator that it is the initial movement that should be considered in adjusting the comparison volume and that extreme care in balancing leakage is unnecessary. The explanation will be evident from a consideration of the effect of a difference as large as 10% in the leakage rate from the two volumes. For this purpose, let the rate be assumed as .03 cubic inches per second, a rather high value for the small pressure increase produced with this instrument. With the above assumption, a measurement taken at the end of one second will be in error by the difference in the amounts that have leaked from the two volumes, namely, .03 — .9 (.03) = .003 cubic inches. The sensitivity of the instrument, however, is about 1%, a difference between the comparison volume and the measured volume of this amount being required to produce a readable deflection on the manometer. The .003 cubic inch error will therefore be too small to be noticed in measuring volumes of the magnitude of engine clearance spaces. The initial manometer deflection observed can therefore be attributed entirely to the difference in the magnitude of the two volumes.

In using this apparatus, care must be taken to prevent temperature changes in either volume as a change of 3 degrees C will change the deflection a noticeable amount and hence vitiate the result. Obviously, such measurements should never be attempted immediately after operating the engine, before it has cooled to normal temperature.

To attempt precise measurements of a clearance volume without first carefully setting the piston at dead center would be utter folly. Markings on flywheel or propeller hub make this a matter of comparative ease in the majority of cases. In the absence of such markings, the clearance measuring apparatus may be connected as was done for measuring leakage with valve J open and L closed. This merely enables the U tube on the instrument to be used to measure the difference between the pressure in the cylinder and the atmosphere. Moving the piston toward upper dead center produces pressure; moving it away, suction. In the Liberty "12" one degree motion of the crank from dead center can be detected with this instrument.

In every branch of internal combustion engineering there is an insistent demand for greater economy in operation and there is at present a decided trend toward increased compression ratios as a means of meeting this demand. With the higher compression ratio the margin between normal operation and preignition is reduced and the manufacturer must exercise greater care in maintaining clearance volumes within close limits. To accomplish this, suitable measuring apparatus will be required and it is in accordance with a policy of anticipating the needs of the industry that the instrument described above has been prepared.

America Enters Aircraft Commission

Through the action of the President the United States will have a representative at the next meeting of the International Aircraft Standards Commission, which was strongly advised last August, at a conference in Washington, attended by representatives of the War and Navy Departments, the Departments of Commerce, Agriculture and Post Office, the National Advisory Committee for Aeronautics, the Society of Automotive Engineers, the Manufacturers' Aircraft Association, the American Society of Mechanical Engineers and the American Society for Testing Materials.

Upon the unanimous agreement that America should participate in the deliberations of the commission, a committee was appointed to present the matter to the President through Secretary of War Baker as the chairman of the Council of National Defense.

Favorable action has been taken by the President, who has addressed a letter to the National Advisory Committee for Aeronautics, requesting it to arrange for the presence of American representatives at the conference.

THE GLENN MARTIN HIGH-LIFT WING

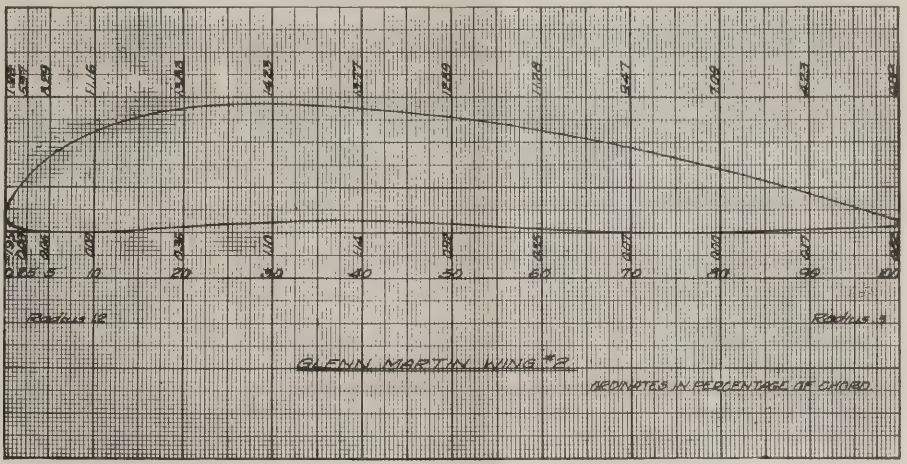
AMONG the many problems confronting aeronautical engineers today there is one of paramount importance; namely, an aerofoil which will permit a wider speed variation to be obtained and will at the same time give a greater efficiency of loading per square foot of area.

Advances in the solution of this problem have been proffered by the Dayton Wright Company in its Variable Camber Wing, by the Parker Variable Camber Wing, by the Gastambide-Levavasseur Variable Surface Aerofoil, and by the Handley-Page new high-lift wing. Each of these four developments tends to solve the problem in different ways.

Recently The Glen L. Martin Company of Cleveland, designed an aeroplane wing which can lift a greater weight per square foot than any other known wing in the world, it is claimed. At thirty miles per hour speed, a model only eighteen by three inches in size carried four and two-thirds pounds per square foot. This is twice as great as the lift of the famous R. A. F. wing, and 25% more than that of the Handley-Page high lift wing according to the only record published. (In lbs., sq. ft. m. p. h. units Lc. 0.00516).

The efficiency of the Glenn L. Martin new high lift wing at high speeds is 10% to 15% greater than the highest value ever recorded for any wing except the Parker Variable Camber Aerofoil. It can not only carry great loads on planes of small dimensions, but for racing machines it is at the present time unequalled.

The "Glenn Martin Wing No. 2" is thick allowing a far more rugged internal construction than the thinner wings ordinarily used. Part or all of the wing bracing may be built inside the wing, reducing the Air Resistance of the plane, especially at high speeds.



THE TILTING MANOMETER

By F. H. NORTON and D. L. BACON

Aerodynamical Laboratory, N. A. C. A., Langley Field, Va.

THE following is a description of a tilting manometer designed by the technical staff of the National Advisory Committee for Aeronautics to meet the requirements of a manometer for use in the Wind Tunnel of the Langley Memorial Aeronautical Laboratory.

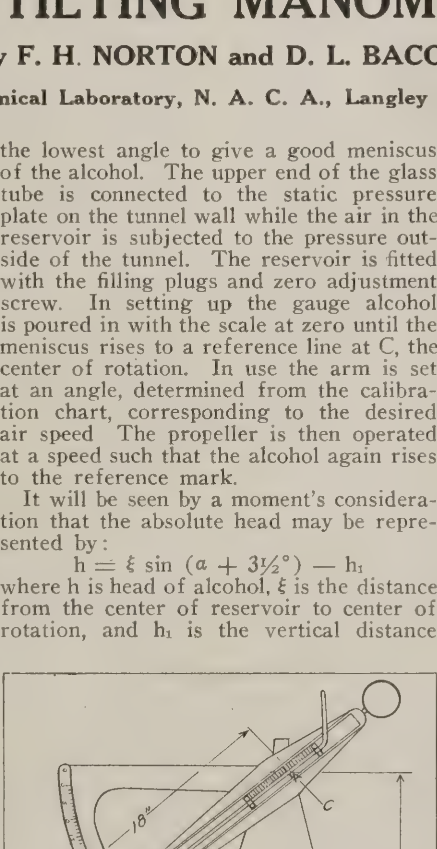
This gauge was designed to meet the requirements of a manometer for use in connection with a static pressure plate, to indicate the wind speed in the tunnel. These requirements are: first, that the sensitivity of the gauge may be made inversely proportional to the pressure to be measured; second, that the gauge may be accurately and quickly set for any desired pressure; and third, that when set at the desired pressure the extent of variation between the existing and the desired pressures may be readily estimated. As the pressure measured between the static plate in the tunnel wall, and the air in the tunnel building is not a simple function of the air speed, it is usual to calibrate the readings of such pressure gauges against actual air speed or impact pressure readings from a pitot tube placed in the center of the air stream. Because of this method of arbitrary calibration, it is not essential that the pressure gauge should be adapted to reading absolute pressure values, although this can be easily computed from the angles in the present gauge.

The mechanical construction of the gauge is readily seen from the drawing. The cylindrical alcohol reservoir A is machined in one extremity of the aluminium arm B which is arranged to swing about the center C over the graduated sector D. A glass tube leads from the center of the reservoir to the opposite extremity of the arm, passing through the axis of rotation. The sector is graduated in degrees, the zero graduation corresponding to a 3½° inclination of the tube from the horizontal, which is found to be the lowest angle to give a good meniscus of the alcohol. The upper end of the glass tube is connected to the static pressure plate on the tunnel wall while the air in the reservoir is subjected to the pressure outside of the tunnel. The reservoir is fitted with the filling plugs and zero adjustment screw. In setting up the gauge alcohol is poured in with the scale at zero until the meniscus rises to a reference line at C, the center of rotation. In use the arm is set at an angle, determined from the calibration chart, corresponding to the desired air speed The propeller is then operated at a speed such that the alcohol again rises to the reference mark.

It will be seen by a moment's consideration that the absolute head may be represented by:

$$h = \xi \sin (\alpha + 3\frac{1}{2}^\circ) - h_1$$

where h is head of alcohol, ξ is the distance from the center of reservoir to center of rotation, and h_1 is the vertical distance from the center of the reservoir to the surface of the contained liquid ($h_1 = \xi \sin 3\frac{1}{2}^\circ =$ constant); and that the sensitivity, considering a vertical tube as having unit sensitively, is $\frac{1}{\sin \alpha}$, thus satisfactorily approaching the sensitivity requirements except for the very lowest pressures.



The Tilting Manometer

In order that the gauge may be set quickly to any given speed after calibration a number of adjustable stops are placed along the scale at every ten miles per hour so that the arm can be easily snapped into the correct position.

This manometer is quick to adjust, is easy to read, always has the meniscus in the same position, and accurately indicates a large range of fair speeds in a comparatively compact instrument.

Wireless Bill is Urged

Washington.—A resolution providing that Congress pass the now pending bill authorizing the Navy Department to accept wireless press messages at a fair rate between the United States and South American countries was adopted by the Senate Committee on Transportation and Communication, February 3rd, on the motion of Senator Fletcher of Florida, chairman of the Radio and Cable Communications Sub-committee.

Another resolution providing for the erection of a powerful radio station on the west coast of Africa was also adopted. The acquisition by the United States of radio stations, cable service and trade papers in Latin-American countries was recommended by Rear Admiral Bullard, Director of Naval Communications. He urged this action so that this country's point of view might be better presented to the southern republics.

FIRST SEMI-ANNUAL REPORT OF THE CIVIL AFFAIRS DIVISION OF THE ARMY AIR SERVICE

(*Concluded from last week*)

Aerial Photography in Connection With City Planning.—This is a subject that has received some attention in France and England but very little as yet in this country. Several applications from cities have been received by the Chief of Air Service, the last being from Macon, Georgia, but it has not been possible as yet to lend any assistance for this important work.

Aerial Photography in Connection With Agriculture.—This promises to be a very important phase of flying wherein the War Department can stimulate a demand for commercial planes. A communication was addressed to the President of the Massachusetts Agricultural College at Amherst which received his hearty approval and which is being checked over by him with a view to the Air Service conducting certain experiments in the course of its maneuvers for the stimulating of this important phase of aviation which may increase the production of agricultural products in the country and tend towards better, scientific farming.

Development of Air Lanes for Dirigibles.—The heavier-than-air portion of the Air Service has developed certain routes across the continent, but owing to the very nature of the airships themselves and the fact that they must select routes both from a meteorological and topographical standpoint, it is not strange to find a local engineer applying to this division for the best possible route for dirigibles across the continent. This data is being worked up in co-operation with the Weather Bureau and the Topographical Branch of the Geological Survey of the Interior Department.

Development of Commercial Planes.—It is the opinion of many authorities that aviation would have made faster progress in this country and indeed in all countries had it not been that the flyer was burdened with the surplus war material and forced to use uneconomical motors and planes for commercial purposes, for those planes having a high speed and performance from a military standpoint were wholly inefficient from a dividend-paying standpoint. The same people suggest that Germany, stripped of all her military surplus aeroplanes, will surge ahead over other nations, less favored, and that the taking over of planes under the terms of the armistice will defeat itself. Whether or not this contention is correct, the fact remains that there are in existence post-war designed planes which, from a commercial operator's standpoint, are much more satisfactory, more reliable, more economical and capable of landing on and getting off smaller landing fields. There being no real industry or market in this country for these planes, it is difficult for the manufacturer to divert the necessary work to the construction of a plane that would fill these requirements. This division proposes to get in touch with manufacturers, ascertain what, if any, proposals they have in this connection, co-ordinate those and issue an advisory pamphlet on the matter.

Aeronautical Insurance.—Before commercial aviation can be considered a sound, legitimate business propostion, it will be necessary to have aircraft insurance. This division is working with the National Aircraft Underwriters' Association towards this end.

Forest Fire Patrol.—A great deal of work has been done in forest fire patrol in the Ninth Corps Area, but little or none elsewhere. Demands from other localities in the United States are forthcoming and in some cases have actually arrived. It will be necessary, therefore, for the Air Service to balance off these requisitions upon its services and establish a priority list consistent with location of troops, equipment and training program.

Foreign Aeronautical Trade Development.—Work of this nature would tend to stabilize the aeroplane manufacturing industry. The opinion of this group is obtained by Supply Group on declaring property surplus, and as this property should be used to good advantage in foreign countries, such as those of South America, where it is essential that American aircraft industry penetrate, it is felt that this division can further commercial aviation by looking out where possible for extension of the trade in South American and other foreign countries.

Aerial Contests for the Stimulation of Aeronautical Development.—All nations that are developing their air forces are considering the offering of prizes for the stimulation of aviation. England last year, through the Air Ministry, awarded prizes to manufacturers for improved design. This country has done little or nothing in this connection other than the awarding of prizes for speed contests, such as the Pulitzer Trophy Race held on November 25th last. In a communication to the Los Angeles Chamber of Commerce a very interesting and at the same time adequate system for awarding prizes is indicated and it is felt that by the institution of this scheme in various localities throughout the country a very great stimulus to aeronautical development will accrue to the good of the War Department.

Timber Cruising.—In connection with aeroplane work over forest areas, it has been found that a company in Canada employs an American with aeroplanes for timber cruising and that they have had very great success and that it is a paying aeronautical commercial enterprise. Steps have been taken by this division to introduce this where possible in this country.

Grand Canyon Development.—A request has been received by the Secretary of War from the Secretary of the Interior asking for aeroplane co-operation in the Grand Canyon, for geological work and for an estimate as to whether or not commercial planes might operate in the Canyon successfully for carrying passengers and viewing the world-famed wonders of the Canyon from the air in this manner. The Superintendent of the Park and the Secretary of the Interior have just disapproved a plan for the construction of cable lines throughout the Canyon, designed to obtain this end. It is felt that the aeroplane could do this better and with greater safety and without detracting from the grandeur of this natural, national monument. A project is being prepared whereby an aeroplane will be sent from the Eighth or Ninth Corps Area to the Canyon to spend two weeks looking over the possibilities, finding landing fields and generally making an estimate so that subsequent action can be taken.

Co-operation with Boy Scout Organization.—The Chief of the Group feels that a great field of activity that will stimulate obtaining reserve lies with the Boy Scout organizations of the country. These organizations have in the past rendered very valuable service by guarding aeroplanes over night where pilots have been forced to land away from aerodromes, and by rendering other useful assistance to stranded aviators. The National Council of Boy Scouts in New York realizes that their forces can render a great aid to the nation and the Chief of Air Service feels that work to the mutual benefit of both can be accomplished with little, if any, cost to the Government. Therefore a project is now being prepared by this division whereby scout organizations of the country will co-operate with the Air Service and the first great work that they will be asked to do is the marking of the landing fields on the model airway.

Photographic Section

The Chief of this section, Lieutenant Wheeler has, in addition to his responsibility as Chief of the Photographic Section, been required to answer for all photographic activities in the group. Following are activities which have been performed by this section which are particularly valuable in the aid of commercial aviation:

Manual of Aerial Photography.—The official Air Service manual of aerial photography was prepared by the Photographic Section and published in tentative form under date of July 18, 1920, as Air Service Information Circular, Volume 1, No. 96.

Work of Photo Sections.—The nine authorized photo sections are designated and located as follows: Photo Section No. 1, El Paso, Texas; Photo Section No. 2, Kelly Field; Photo Section No. 4, Post Field; Photo Section No. 6, Camp Stotsenburg, Philippine Islands; Photo Section No. 7, Langley Field; Photo Section No. 11, Luke Field; Photo Section No. 12, France Field; Photo Section No. 14, Mitchel Field; Photo Section No. 15, Crissy Field. In addition to the usual work done by the photo sections, including all photographic work necessary at the fields where they are located and the making of mosaics, the sections in Texas have co-operated with the Corps of Engineers in the making of photographs for use in preparation of military maps. Other sections, namely, Photo Sections Nos. 7, 14 and 15, have devoted their operations very largely to the making of aerial photographs of coast defenses. The making of these pictures of all the coast defenses in the United States was directed by the Adjutant General of the Army at the request of the Chief of Engineers and the Chief of Coast Artillery. At present this work is almost half completed.

The 4th Photo Section did the necessary aerial photographic work in connection with the Air Service School of Line Maneuvers at Fort Leavenworth, Kansas, consisting principally of the making of a photographic mosaic of the reservation, and individual aerial photographs for various uses in connection with maneuvers. Later, this section made a mosaic of the Artillery Firing Center at Camp Knox, Kentucky.

Work in and Near Washington.—Aerial photographic work in and near Washington has been performed by photographic personnel from Langley Field, and that on duty in the office of the Chief of Air Service, for the use of the Secretary of War, Surgeon General, Chief of Motor Transport Service, Chief of Engineers, Officer in charge of Public Buildings and Grounds, Fine Arts Commission, and the Chief of Balloon and Airship Division of this group.

Photographic Work in New York State.—Two photographic officers were sent from the photographic school to Mitchel Field, from which they made excellent aerial photographs of the New York City river and harbor front, which were used in connection with the plans for the improvement of New York Harbor. These officers then proceeded to Rochester, N. Y., and co-operated with the Eastman Kodak Company in testing a new type of aerial camera. This co-operative work has been productive of much valuable information to the Air Service.

Photographic Work by the Alaskan Flight.—The Photographic Section gave advice as to the kind of photographic equipment needed by the Alaskan Flight, and originated the orders for the procurement of the equipment and material, and at the same time arranged for the instruction of two of the officers assigned to the flight to receive instruction in the use of one of the newer models of the aerial cameras carried by the expedition. While conditions did not permit of the making of a large number of aerial photographs, some very excellent and interesting photographs were, however, secured by this expedition.

International Rifle Matches.—A photographic officer was sent from the Air Service Engineering Division to Camp Perry, Ohio, to demonstrate the usefulness of aerial photography at the International Rifle Matches held at Camp Perry. Some excellent photographic work was done.

Co-operation With the Mapping Departments.—The Photographic Section has co-operated with the Corps of Engineers in the preparation of detailed plans for the making of aerial photographs to be used in preparing a map of the Tennessee River Basin in Tennessee. The Chief of the Photographic Section represented the Air Service at a conference on this subject held in the office of the District Engineer, U. S. A., at Chattanooga, Tennessee.

The Chief of the Photographic Section was appointed a member of a subcommittee of the standing committee on photographic surveying of the Board of Surveys and Maps of the Federal Government, and as such assisted in the preparation of a report on the application of aerial photography to map making. This report is a comprehensive and valuable survey of the subject, and, as many requests have been received for copies of it, steps have been taken to have it published as an Air Service Information Circular.

The Photographic Section has also co-operated with the Geographic and Topographic Divisions of the U. S. Geological Survey. The co-operation with the Geographic Division has consisted in furnishing aeroplane facilities and aerial photographs to an expert geographer of the Survey for use in the intimate study he is making of the application of aerial photography to geography. The co-operation with the Topographic Division of the Geological Survey has embraced the making of aerial photographs for the use in the revision and preparation of topographical maps. Requests from the Geological Survey on hand at present involve the photographing of more than 45,000 square miles of territory, the separate areas being located in most of the States of the Union. This work is being engaged upon to the very limited extent that trained Air Service photographic personnel permits.

Similarly the Air Service is co-operating with the U. S. Coast and Geodetic Survey by making aerial photography for their use in the revision and preparation of maps or charts issued by that Serivce. Compliance with the request on hand from the Coast and Geodetic Survey will necessitate the photographing of upwards of 2,500 miles.

Commercial Application of Aerial Photography.—All efforts possible are being made to assist commercial concerns engaged in the making of aerial photographs and in the manufacture of aerial photographic apparatus. To this end, a comprehensive statement as to the policy governing photographic work in the Air Service is being prepared for submission to the Chief of Air Service. If this policy is adopted, it will prevent Air Service personnel from unintentionally encroaching upon the field which should be left to the commercial aerial photographer. Aerial photography in connection with agriculture, the lumber industry and other pursuits, is being investigated and every opportunity presented is seized to encourage its use.

Miscellaneous.—Efforts are being made to keep in close touch with the developments of aerial photographic equipment and methods abroad. Sample lenses and cameras manufactured in other countries are being purchased for use in connection with development work in the Air Service.

Steps have been taken to secure authority for the organization of additional photo sections. If this is secured, additional units will be placed in the field, organized from personnel at the photographic school as it becomes sufficiently trained in photography.

The need of the Air Service for a control photographic laboratory and negative repository to be located as near Washington, D. C., as possible has been called to attention and detailed plans are now in course of preparation.

Steps have also been taken toward the preparation of an official Air Service Manual on the interpretation of aerial photographs. This will involve the compilation of valuable information which at present is scattered, not only throughout the Air Service, but even among several branches of the Army.

Practical instructions or working directions for the use of the new Air Service camera known as type K-1 were prepared and issued in stenciled circular form to all Air Service photographic activities.

H. E. HARTNEY,
Captain, Air Service, Chief, Civil Affairs Division.

THE 300 H. P. BENZ AIRCRAFT ENGINE

By DR. A. HELLER

(Translated from "Zeitschrift des Vereines Deutscher Ingenieure," by Paris Office, N. A. C. A.)

DURING the last few years, the firm of Benz has evolved this type of engine which was first designed and constructed toward the end of 1914, but which was then temporarily set aside for the time being in favor of the simpler six-in-line construction because of the urgent need for standardizing aircraft engines.

The latest 300-horsepower engine, with its 12 cylinders placed at an angle of 60° (Figs. 1 to 6), not only realizes a long-cherished conception which had been amply tested from a constructional point of view, but has also received such refinement in detail due to the extensive working experiences of the last few years that it may be described as a perfect example of modern German aircraft engine construction. Such being the case, a detailed description of the development of the constructional points of the engine may be justifiable, as given below:

The engine has 12 cylinders of 135 mm. bore and 150 mm. stroke. Each pair of cylinders serves one of the crankpins of the six-throw shaft and the engine normally produces 300 horsepower on the ground, at 1,800 r.p.m., with the carburetor at full throttle—which is only possible temporarily; and under the same conditions at 2,000 r.p.m., the engine develops 400 horsepower.

The engine is a so-called "altitude" engine, its decrease of power with diminishing air density being compensated by over-dimensioning the cylinders and over-compressing up to a certain altitude. A normal propeller is driven by means of a rotary reduction gear mounted on the crankcase, the gear ratio being 29:19. Its weight without water, oil charge, propeller boss, ignition magneto and the engine exhaust manifolds is about 430 kg., which would be about 1.43 kg/HP as relative to normal power on the ground.

The construction of the cylinders (see Figs. 7 & 8), which are interchangeable and are set comparatively deep in the crankcase in order to diminish the width of the engine, is especially characterized by the use of inner cylinders made of forged steel and screwed into a cast-iron cylinder head (Figs. 7, 9 & 10). To prevent the possible penetration of cooling water into the combustion chamber at the screwed connection of these two parts, the top rim of the steel cylinder liner is jammed into a groove in the cylinder head when screwed down, the cylinder head being bent slightly outward so that the top rim of the steel tube is turned up sufficiently for it to press firmly against the side of the groove. In screwing it on, the cement filling of the groove is squeezed out through minute holes bored for the purpose. The bushings of the spark plugs are screwed into the upper part of the steel sleeve, and then autogeneously welded to ensure perfect tautness at those points. When the cylinder has been tested at 30 times the working internal pressure, it is fitted with a water-cooling jacket made of sheet steel from 1 to 2 mm. in thickness. This cooling jacket is autogeneously welded to the steel sleeve as well as to the cast-iron cylinder head. Experience shows that there is no difficulty in welding sheet steel to cast iron.

Benz & Co. have been comparatively slow in adopting the use of steel cylinders in aircraft engines and thereby ensuring a considerable saving in the weight of the engine. This may be traced to their desire to avoid the decreased reliability entailed in working with steel cylinders when cast-iron pistons were used. Even when such pistons were plentifully oiled and carefully measured for compression conditions, they showed a tendency to cause excessive friction; and this was really satisfactorily overcome only when each piston was separately ground into its own special cylinder. This is a process which would seriously hamper production and would render it almost impossible for a piston to be changed in the course of flying. When aluminum alloy pistons were introduced, Benz & Co. immediately adopted the use of steel cylinders.

The cylinders are fixed on the specially adapted roof-like milled top side of the crankcase, each with 4 screws placed as close as possible to the axis of the cylinder. The cylinder flanges, which are comparatively large in size, are milled as far as possible with a view to economizing in weight. The cylinder heads are so closely jammed against the ends of the water-jacket sleeves that they can be made sufficiently tight by means of simple rubber rings covered with sheet-steel washers (SKF Schellen). This tightness has been maintained even when the rubber washers were of rather poor quality.

The cylinders are served by a large intake valve and two small exhaust valves (Figs. 11 & 12), by which means there is no danger of the deformation of the exhaust valve at high temperatures. All the valves are operated by a camshaft located between the two rows of cylinders by means of push rods and single and double rocker arms (Figs. 11 to 15). These rocker arms are all mounted on ball bearings. The camshaft, with its 5 bronze bearings, can be drawn out with the bearing when the guides of the push rods are removed and the screws of the camshaft bearing loosened.

Double springs of very low constructional height being used for the intake valves and partly sunk in the cylinder heads, the valve rocker of the intake valve can be brought obliquely under the double rocker of the exhaust valves and the push rods are thereby kept at the requisite distance from one another and from the cylinder heads. The entire construction of this mode of valve-operation, as compared with the usual method using special casing with enclosed camshaft on top, is marked by the relatively easy accessibility of the valves, springs and rockers, and the facility with which the valve rocker bearings can be lubricated. The ball bearing of the valve rockers, filled with lubricant only when the engine is built or thoroughly overhauled, actually needs no further oiling. This type, which was first introduced in the Imperial Prize Engine, in 1912, has so well proved its worth that the use of ball bearing has been adopted for the valve rockers of other engines with the camshaft located below.

In operating, attention must be given to the necessity for leaving a play of about 0.4 mm. between the valve stem and the valve rocker tappet pin when the engine is warm, so that the valves may be thoroughly closed by the time the engine is cool. Special importance must also be attached to there being a similar amount of play for all the collectively-driven exhaust valves.

Each of the valve stems is connected with the valve spring by a two-part cone. This cone is located in one of the grooves of the valve stem, and is held fast by the pressure of the spring.

As the valve stem heads are tempered, the edges of the groove must not be hard enough to cause scratching. To prevent the valve from falling freely into the cylinder in case of breakage of the valve spring, and thereby doing great damage, the cone is held in the spring collar by an expanding ring. A former method of locating the valves in an extension of the cylinder head in such a manner that they could not fall through, has been almost entirely abandoned on account of the difficulties involved in the interior structure of the valve, and, furthermore, as it ensures so little security from dam-

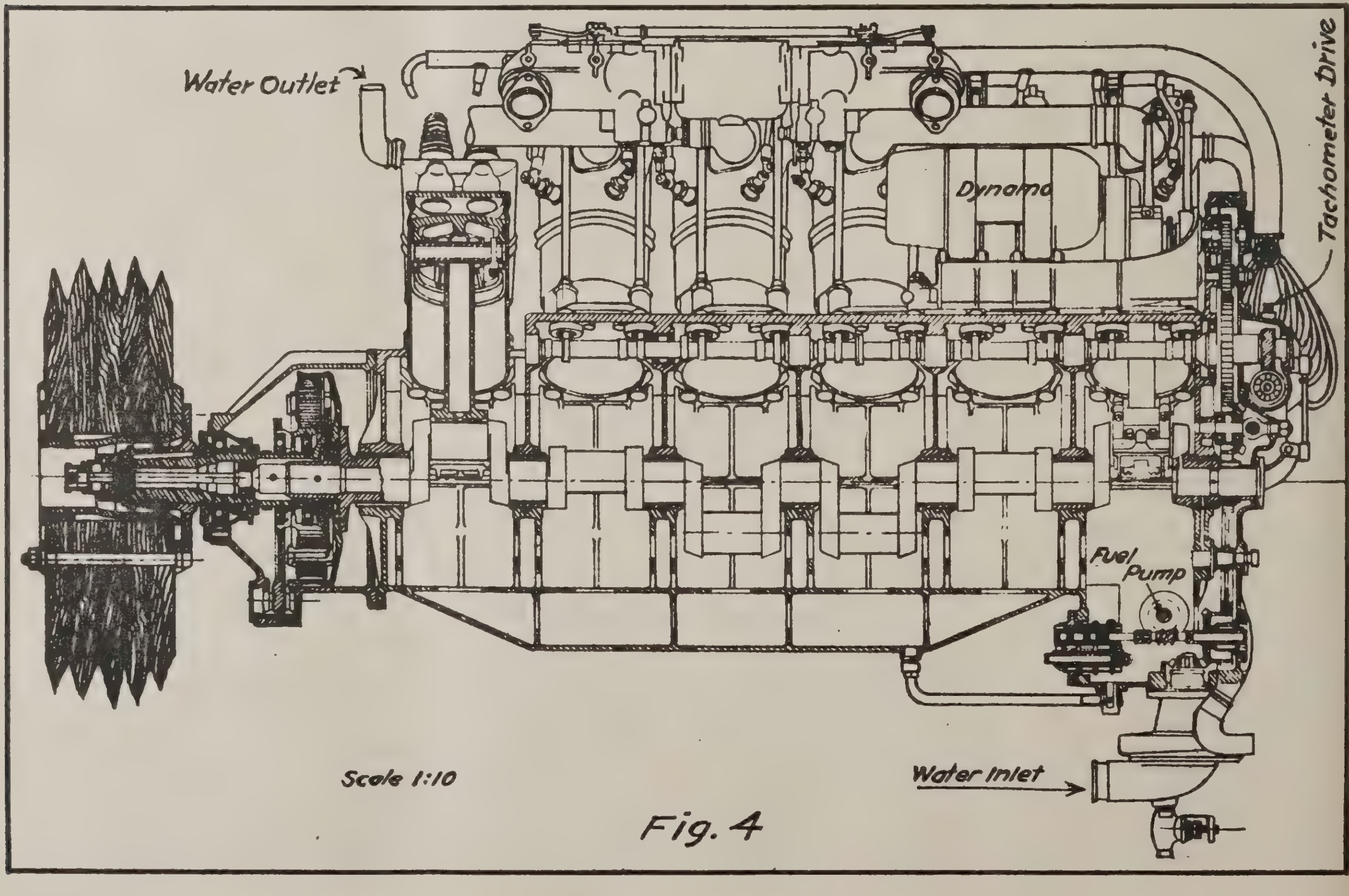


Fig. 4

age; the valve-collars alone being often wrenched off, in which case there is no way to prevent falling.

The push rods are lengths of seamless steel piping with rounded wooden pegs fastened with pins at both ends. The force of the valve springs alone holds them between the valve tappets and the rocker, and they can therefore easily be taken out if necessary.

The construction of the pistons (Figs. 16 to 18), which are made of the usual aluminum-copper-zinc alloy cast in an outer chill-mold with an inner sand-core, is characterized by tubular steel bushing, cast in the piston pin bosses. By means of these bearings it is also possible to give considerable length to the connecting rod bearing on the piston pin. The piston pins are open at the ends and are secured laterally by conical pegs which enter the eyes from below. The drag weight of the piston, as influenced by friction, can be compensated within a few grammes by an oil drip ring on the lower interior rim of the piston. By this method a piston of any series may be built into the cylinder of an engine without disturbing the compensation of the whole. The pistons are fitted into the cylinders by four small high-rimmed cast-iron washers. For aluminum pistons much depends upon this jointing, as they require a comparatively large amount of play when fitted into the cylinder on account of the great expansion of the jointing due to heat.

The use of aluminum pistons is one of the progressive steps of later years both from a thermo-technical as well as a purely practical point of view, and they are now regarded as a useful factor in the technics of power-propelled vehicles of the future. Their use is attended by many practical advantages, especially with regard to economy in the wear of the cylinders, which do not, even after many years' wear, need to be reground as at present. Should the pistons become worn, for instance, from insufficient oiling, not the cylinders but the pistons only would be affected, and the latter are far more easily renewed. One of the strongest arguments against the general use of engines with welded cylinders is thus done away with. From a thermo-technical viewpoint, the good heat-conducting properties of aluminum are an advantage on account of the comparatively low temperatures that always prevail on the upper side of the piston wall, and which can be detected by the absence of fused oil residue. This prevents the seizing of the piston rings by fusion, which frequently causes derangement when cast-iron pistons are used. It has been repeatedly proved that the power of an engine can be raised 10 horsepower with a certain number of revolutions and under other similar conditions by the installation of an aluminum piston. Mean effective piston pressures of 9 atm. or even more can also be obtained on high speed engines without any hardness or jolting in running, and all these advantages are due to the good heat-conducting quality of the piston. The comparative coolness of the top side of the piston prevents the intake mixture from heating too rapidly, and thereby improves the cylinder charge, while the degree of compression ratio that can be attained without risk of spontaneous combustion is greater, and the highest possible mean piston pressure is attained later with aluminum pistons as compared with cast iron. Taken as a whole, the saving in weight by the use of aluminum pistons applied to automobile engines rather than aircraft engines is no more than cast iron, as the short pistons of the latter require the addition of ribs for stiffening.

The structural formation of the master connecting-rod (Figs. 19 to 24) is remarkable for the successful location of the joint of the crankpin end, which is as far as possible from the immediate influence of the forces acting from the piston, and also because the screws securing the crankpin end are so precisely threaded as to lessen the risk of their shearing. This does not obviate the need of using studs for the connection on one side, although blank bolts that could be pushed through would be preferable. The bolt or pin connecting the secondary-rod to the master-rod is securely held in a clamp-bearing. Bronze bearings are used between the secondary connecting-rod and the bolt and the usual bronze cap white metal bearing on the crankpin for the master-rod. The stems of the connecting-rods are round, and are bored from the piston end in order to ensure a tubular cross-section specially capable of resistance to bending and inside which the oil channel leading to the piston-pin can easily be located.

The engine fittings are arranged on the principle that the comparatively inaccessible end at the propeller should be left as free as possible when the engine is mounted on an aeroplane. On the other hand, the constructional length of the engine should be curtailed as much as possible in order to avoid any detrimental influence on the turning ability of the aeroplane. For the same reason the carburetors, which are joined in couples, each supplying 3 cylinders, and the magneto driven by the camshaft are located in the space between the cylinder rows, while the spark-plugs, with the pumps for fuel, oil, and water are placed at the rear end of the engine within reach of the pilot's seat.

(To be continued)

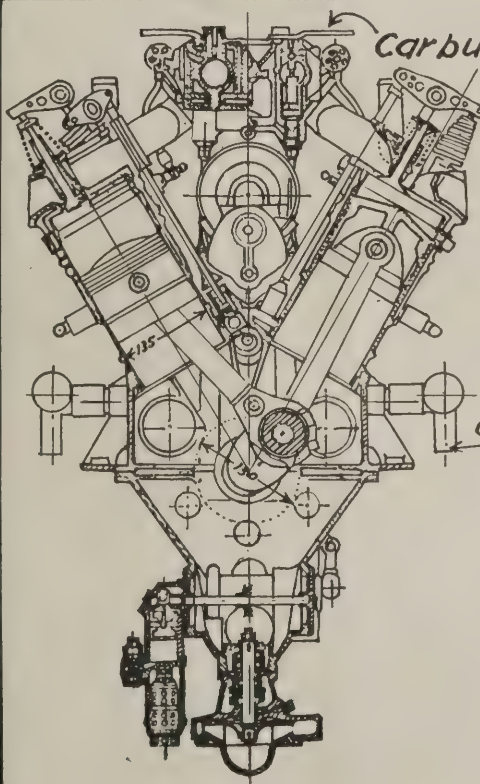
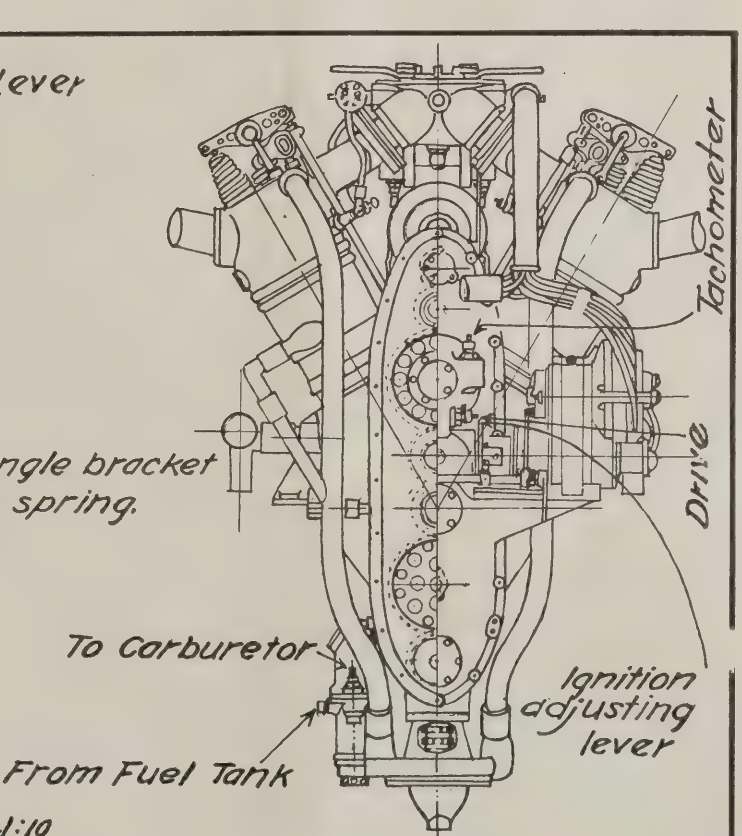
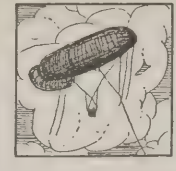


Fig. 5.

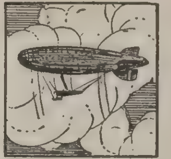


Scale 1:10

Fig. 6.



FOREIGN TECHNICAL DIGEST



The Parachute

An account is given of different French and American aeroplane-type parachutes, with reference to the manner of attachment and the operation in the machine. Diagrams and photographic illustrations show how the parachutes are fixed to the backs of the airmen, and also to the machine. Three different tested methods are described in detail. (L. P. Frantzen, *L'Air,* Sept. 20, 1920. 2 pp., 5 figs.)

The French Hydro-Gliders at Anvers

Descriptions are given of the hydrogliders, aerially propelled, at the Anvers meeting, over a course of 200 kiloms. without stopping and with 10 passengers on board, exclusive of the pilot and mechanic, for the first course. The machines of Lambert are described, with illustrations and curves of power and resistance at different speeds. Tabular statistics of the Lambert hydro-glider are given. (*L'Aéronautique,* Sept. 30, 1920. 3 pp., 5 figs.)

A New Aircraft Direction and Speed Calculator

A circular form of calculator for obtaining the course and speed, from the known machine's and also the wind's course and speed, is described and illustrated.

The device described is based upon the solution of the triangle of relative velocities, and can be used in conjunction with a nomogram for estimating the duration of the journey. Its advantages are described, and an actual example illustrating its use is worked out. (A. B. Duval, *L'Aéronautique,* Sept. 30, 1920. 3 pp., 4 figs.)

The Variable Pitch Propeller

The writer describes the principles employed in the following representative airscrews, namely, the Chauviere, the Clement-Bayard Dirigible type, the Italian Dirigible and the Lévasseur types. Line-diagrams are given illustrating the action of the mechanisms in each case, and each propeller is dealt with under a separate paragraph. (M. L., *L'Aéronautique,* Sept. 30, 1920. 2 pp., 5 figs.)

Aeroplane Design

This paper was read before the Cambridge University Aeronautic Society of England by Capt. F. S. Barnwell, and discusses in detail the load-carrying power of the aeroplane.

It is convenient to divide up and consider the total drag in three parts:

Drag of wing surface alone, which I shall call "Wing Drag," and denote by ν_w.

Drag of necessary stabilizing surfaces (tail plane with elevator flaps, fin and vertical rudder), which I shall call "Stabilizing Drag," and denoted by ν_s.

Drag of *all* the rest of the machine, which I shall call "Residual Drag," and denote by ν_R.

Now the total lift is almost entirely supplied by the wing surface, at normal flight altitudes—that is to say, wing lift must be practically equal to total weight.

Probably the optimum lift over drag for wing surface of a full-sized aeroplane is about 25 to 1, and, considering the very great amount of research that has been done upon the wing forms, it is unlikely that we shall be able to improve largely upon this. Therefore, we must have a drag at least one twenty-fifth of the total weight, simply to maintain the aeroplane at a constant height. The Stabilizing Drag also has some fairly definite minimum value: probably we cannot get below about 12 per cent. of the wing drag. Therefore, simply to maintain the aeroplane at a constant height in a stable and controllable condition, we must have a drag of at least one twenty-second of the total weight.

The Residual Drag, however, is a much more variable quantity, and offers far greater possibilities of improvement. (*Aeronautics,* Dec. 30, 1920. 2 pp., 1 diagram.)

The De Pischof Avionette

An all-metal biplane of total weight 102 kilogs., with a remarkable simplicity of construction. No undercarriage is fitted, the wheels being mounted on the center section front spar. The wings are removable and the interplane struts fold about their middle point, thus allowing each pair of wings to be folded completely flat.

It is fitted with a two-cylinder air-cooled Clerget-Blin engine of 16 hp., with a Zenith carburetor and Luminere airscrew. Characteristics are: Span 5.2 m., length 3.5 m., height 1.3 m., speed 90-95 km.p.h., climb 1,200 m. in 52 minutes. (*Aeroplane,* Dec. 15, 1920; ⅞ p., 2 figs.)

An Albatross Commercial Machine "L-57"

This is a monoplane single-engine tractor machine designed for passenger or freight carrying. The pilot and engineer are in front and slightly above the wings, and the cabin under the wings. The cabin measures 9 ft. 3 in. by 3 ft. 10 in., by 5 ft. 3 in., and carries six passengers. The wings are of cantilever type, with a negative dihedral to the leading edge at the roots gradually "washing out." The wing is 2 ft. deep at the root, and this space is used as a luggage compartment. The petrol tanks are also in this space. The engine may be either a 160 hp. Mercédès, 185 hp. B.M.W., or a 200 hp. Benz.

General particulars are: Span 46 ft. 6 in., length 34 ft. 2 in., height 11 ft. 7¼ in., chord (max.) 10 ft. 3 in. Other particulars vary with engine. (*Flight,* Dec. 9, 1920; 1 p., plan and elevation.)

Survey and Aerial Photography

This is an account of the photographic method of making surveys, treated from a general standpoint.

It is shown that aerial photography affords a simple, yet rapid, method of plotting out areas, with the advantage that precise details are included. The method of scaling photographs by reference to three or four known points on the ground covered, the distances between which are obtainable, is described. The procedure adopted for taking, developing, recording, and applying the photographs is also outlined. It is pointed out that in France the existing ordinary survey occupied 38 years, and that a new survey would require another 25 years, whereas by the aerial photography method only about 5 years would be necessary for the whole country, including the devastated territory in the North; moreover, the cost of the survey would be reduced from Fr. 22.50 per hectare (in 1840), and Fr. 6.61 per hectare (in 1905), to a considerable lower value. Examples are given of aerial photographs (mosaics), with the corresponding line-plans, and comparative line-plans determined by the earlier survey methods. (A. B., *L'Aéronautique,* Sept. 30, 1920. 3½ pp., 3 figs.)

Aircraft in Scientific Research

The author criticizes an article under the above heading which appeared in the American periodical *Flying,* March, 1920.

In this article it was suggested that artificial solar eclipses might be produced by means of a disc fitted on an aeroplane, and the resulting corona effects studied by means of a camera fixed to the machine. This the author considers impracticable. He puts forward a more practical line of scientific research, viz., the study of meteorological conditions at high altitude (20,000 to 30,000 ft.). At the low temperature here existing, the air is very frequently supersaturated, due to the absence of condensing nuclei. An aeroplane flying at Munich at a height of 30,000 ft. caused the formation of an ice cloud 50 kilometers long in its wake, the undisturbed air in front of the machine being quite clear of ice.

The possibility of thus "infecting" dust-free air by means of aircraft is worthy of the greatest attention. (Dr. H. H. Kritzinger, *Luftfahrt,* July, 1920. 2 cols.)

Notes on Sustentation Airscrews

The problem of the ascensional speed of a helicopter is considered by a fairly simple analytical method, and a linear type of formula is arrived at for the speed, weight, and power, which is compared with Breguet's formula, and calculations are made. (M. Lamé, *L'Aerophile,* Sept. 1-15, 1920. 1½ pp., 1 fig.)

Postal Parachutes

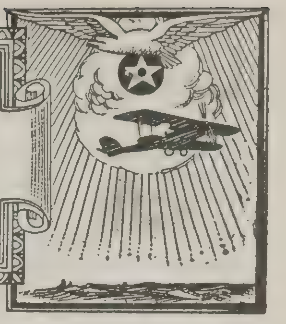
The article describes the theory and action of the Perrin-Bourgois postal parachute, which is contained in a box underneath the observer's seat in the machine, and released over its destination. Diagrams and photographs are included which serve to explain the functioning of the parachute. Tests are described, and the advantages of this type are emphasized. (L. P. Frantzen, *L'Aerophile,* Sept. 1-15, 1920. 3 pp., 4 diags.)

Variation of Wind Elements in Paris Region

The results are given of 322 wind observations at heights up to 4,000 metres of the measurements of the wind in the Paris region.

Some interesting deductions are made, based on the percentage variations of the wind velocity and wind direction with the altitude, in relation to the geographical quadrant from which the winds occur. The fact of the greater percentage of right-hand rotations in the S.E. and S.W. directions and of left-hand rotations in the N.W. (and occasionally the N.E.) directions, is shown to accord with the theory of a prevalent westerly component of the wind in the upper regions of the air. Tabular values of the results are given. (J. Rouch, *L'Aerophile,* Sept. 1-15, 1920. 2 pp., 3 figs.)

NAVAL and MILITARY AERONAUTICS



New Director of Naval Aviation

Capt. William A. Moffett, U. S. N., has been assigned to duty as Director of Naval Aviation in the Office of Naval Operations, relieving Capt. Thomas T. Craven, U. S. N., who is due for sea duty. Pending the adjustment of important matters in connection with Naval Aviation, however, Captain Craven will remain on duty at the Navy Department for some time.

In the World War Captain Moffett was in command of the Great Lakes Naval Training Station, and is now in command of the U.S.S. *Mississippi* of the Pacific Fleet. He has taken a keen interest in aviation and has given much attention to the activities of the air detachment of the fleet. Captain Craven in his post as director during the last two years has shown an ability and capacity for advancing the interests of naval aviation which has been highly appreciated in the Navy Department. In his tenure the NC-4 made the transatlantic flight, in the preparation for which the most important administrative duties devolved upon Captain Craven.

With a Bureau of Aeronautics and a Flying Corps organized in the Navy, the opportunities for the chief of that bureau will be immensely enhanced, but under existing conditions relative to aviation Captain Craven has made a steady advance, and he will leave to his successor a firm foundation for the upbuilding of a large naval air program.

Loening Monoplanes Arrive at San Diego

Among the new planes listed for or already en route to North Island Station are six new F-5-L's of the latest improved type, 22 Loening N-8-O monoplanes, equipped with 300 hp. Wright motors; 10 Vought E-7's; 6 Vought SF's and 18 DH-4-B's. These "ships" are for the most part destined for the Pacific Fleet Air Force.

In addition to the six F-5-L's now under way to this station, 12 more will be dispatched here within the next two months. Three Loening monoplanes are already on the station and in process of erection. These planes, it is reported, will ultimately be placed on all the major class of battleships, since they may be launched from the decks of ships with ease. Rated as capable of a maximum speed of 160 miles per hour in the air, they have a wing-spread of 37 feet, 10⅛ inches. They are powered with one 300 hp. Wright motor. They are of two-seater combat type, with machine gun tourelle in after cockpit and have flotation apparatus already installed.

The ship-plane squadron will be materially augmented with the arrival of the Loening monoplanes and their introduction is being watched with much interest by all the naval aviators here, for it marks the first appearance of this type on the Pacific Coast. The "Loenings" have established a splendid record of performance on the Atlantic Coast, where they have undergone exhaustive tests.

Mather Field to Be Enlarged

Sacramento dispatches state that Mather Field is soon to be the largest Army Air Service garrison in the Ninth Corps Area with five service squadrons and approximately 1,000 men. It is understood that the northern field is to be the central base for all Air Service forest fire patrol operations during the coming summer.

Large Tent Hangar

The largest tent hangar in the world has recently been erected at McCook Field for test. This hangar is 130 ft. by 30 ft., with a clear opening across the front. It is large enough to accommodate three Martin Bombers and should prove very valuable in service use if it withstands the weathering test satisfactorily.

Chemical Warfare in the Air

A DH-4B, equipped by the Chemical Warfare Service with gas tanks was flown on a test flight a few days ago, the object of this test being to determine the feasibility of using gas against an enemy in the air and against troops on the ground. This plane was equipped with two gases which released formed a black smoke in the flight path. It is the intention of this command to adopt this method for camera obscura work, the assumption being that a plane cannot readily be seen against a blue sky, whereas the smoke can be seen at all times.

Recent Application of Radio to Military Aeronautics

The use of radio communication, both telegraph and telephone, on the military aeroplane is perhaps the latest application of radio science, increasing tenfold the usefulness of the aeroplane and already influencing the design of military aircraft. Aeroplanes have been called the eyes of the Army, but eyes without means of instantly communicating images and impressions registered upon the retina would find but a limited sphere of application. It is in the performance of this function that radio finds such an important place in military aeronautics. The dots and dashes of the Morse code transmitted from the trailing aerial of the aeroplane carry to the ears of the artillery battery commander the correction for each shot fired, enabling him to group his hits on an invisible target with a degree of accuracy as great as is possible when the target can be seen, or bring to a waiting general news of enemy troop movement observed from the air.

Squadrons of Attack Pursuit Planes can be maneuvered in flight by means of the wireless telephone from the aeroplane of the squadron commander or from the ground easily as a company of infantry is handled. By the same means a machine engaged in aerial combat and outnumbered may call for assistance.

Bombing planes lost in the fog or darkness are directed unerringly to the home aerodrome by the radio direction finder and aeroplanes without pilots, controlled entirely by radio, are already a reality.

The Air Service of the Army, realizing the importance of this newest phase of radio, has established a school for the training of personnel to install, operate and maintain the radio equipment of aeroplanes at all the flying fields throughout the country. Radio engineers and operators, as well as experienced amateurs, may qualify for attendance at this school upon application to any Army recruiting officer or to the office of the Chief of Air Service, Washington, D. C.

Heavy Bombardment Squadron

The 258th Aero Squadron at Aberdeen Proving Ground is being organized into a Heavy Bombardment Squadron. It is the intention to equip the squadron with the new type Martins and Handley Pages. Flight A is now at Langley Field and is taking over the new equipment. Flight B is at Aberdeen and is carrying on experimental work with bombs, sights and chemical warfare experiments.

First Test in New Air Service Engine

The initial run of the new Engineering Division 700-horsepower Model "W" engine was made on January 10th with very satisfactory results. This engine was completely designed by the Staff of the Engineering Division at McCook Field. This engine is of the W type, having eighteen cylinders arranged in three banks of six, and develops more horsepower than any engine which has been built in the United States. The actual figures on the test have not been divulged, but are said to exceed the designers' expectations.

French General on Aerial Armaments

The next war, says the French General Maitrot, holds as many surprises on land as on sea. France, since the armistice, has perfected a projectile so powerful that a dozen would wipe out a city like Berlin. Of aeronautics, General Maitrot says: "Whoever masters the air will rule the earth." The aeroplane will be undisputed master of future territorial battles.

The great danger which surface vessels run in the future is shown by the power of the new French air bombs. At the time of the armistice the French already were preparing a half-ton projectile which, if it exploded within a hundred feet of a cruiser, would infallibly sink it. The latest French bomb of this type weights a ton, or twice as large as is needed to sink a cruiser.

The rapid pace which an aeroplane can travel nowadays must also not be forgotten. "At 200 kilometers an hour," he points out, "it would take only three hours to fly from the right bank of the Rhine to Paris. In a few hours our capital could be annihilated without a struggle, no resistance being possible. Even at a height of 15,000 feet it is remarkable what accuracy can be obtained by a bomber. If he descends a few hundred feet the precision of his aim is alarming.

"Air projectiles can be made to deal certain death by containing poison gas as well as explosives. By using the new methods of compressing noxious gases, it will be possible with gas-laden bombs to submerge entire districts in poisonous waves."

FOREIGN NEWS

Renewed Agitation for Separate Air Ministry in Britain

News of Mr. Churchill's departure from the War Office has been the signal for a revival of the campaign to show the necessity for a separate Air Ministry which will not be subordinate to the War Secretary, and many appeals have been made to the British Government to return to the original 1917 plan, while others advocate a ministry of defence which shall be over both the navy and the army air services.

Advocates of this scheme insist that while there may have been doubt regarding the efficiency of the air service during the war, there is no doubt about what it can do in the future in connection with defence work, especially since steps have been taken already to maintain order in the mandatory countries under British rule by a vast extension of the air service, thus relieving thousands of British troops from duty in those regions.

Also it is argued that the air service has taken its place as a third arm of the nation's defence and that it is equally as important as either the navy or the army, while the balance cannot be held equal if one Secretary rules two arms of the country's defence.

Continental Air Traffic

The Air Ministry has issued a statement giving the number of aircraft of all nationalities which departed for and arrived from the continent and the total number of passengers who travelled on continental air services during the quarter October-December, 1920.

The totals of departures and arrivals of aircraft to and from the continent since the opening of the first service on August 26th, 1919, until the end of 1920 were:—Departures 2131—Arrivals 2022; Grand total 4153. British machines contributed 3321 to the latter figure, French 721, Belgian 104 and other nationalities 7.

The totals for the three months October-December, 1920, exceeded those for the six months October 1919-March 1920. During the former period departures and arrivals were each 406 whereas during the latter period they were 388 and 346 respectively.

Japan's Share

Japan is to receive about 50 machines of a recent design, seized in Germany by the Inter-Allied Commission. A considerable sum has been voted by the Japanese government for the construction of hangars at the military aerodromes of Tokorozwa and Kagamigahora; and two airship sheds at Juterbog, near Berlin, are to be taken down, sent to Japan and re-erected with the aid of German engineers. Japan is also expecting to receive one of the Zeppelins at Seddin, Pomerania. Thirty British Naval aviators are being loaned by the British authorities to instruct Japanese naval officers in the science of aeronautics and aircraft construction. They will report in Japan in the spring of 1921.

Handley Page Records

Continental Air Services (in conjunction with Cie Messageries Aériennes)
September 2nd, 1919—Jan. 1st, 1920

Passengers carried (exclusive of mechanics)	4,184
Freight carried	216,805 lbs.
Mileage covered	324,850 miles

France-Morocco Air Male Service

According to information received from the French Post Office. the Air Mail Service between Toulouse and Casablanca (Morocco), is now being carried on three times, instead of twice a week, in each direction. Outward Air Mails leave Toulouse at 7:30 a. m. on Mondays, Wednesdays and Saturdays.

The mail areoplanes call at Tangier and Rabat.

Deutsch de la Meurthe Memorial Prize

A prize of 200,000 francs has been offered to the Aero Club of France by Mme. Deutsch. de la Meurthe, in memory of her husband. the late M. Henry Deutsch. de la Meurthe, to be devoted to a competition for commercial machines built in France and owned by French concerns. It will be termed the Grand Prix de l'Aero Club de France, and the regulations have just been issued. The first prize will be 100,000 francs, and the winner will also receive a gold medal, while the second will receive a silver-gilt medal and the third a silver medal. The classification will be according to the "commercial speed" of the machine over the complete course, but this must not be below 50 kiloms. an hour. The start will be made from Bourget, then on to Ponchin (Lille), approximately 200 kilometers, turning above the aerodrome at a height not exceeding 200 meters, back to Bourget. where a landing must be made. then on to Pontlong (Pau), approximately 650 kilometers, for another landing, back ot Bourget, land again, then to Frescaty (Metz), approximately 275 kilometers. turning above the aerodrome and back to Bourget for the final landing. Each competing machine must carry a load made up of (1) six sacks of sand, each weighing 80 kilogs.. representing six passengers and each placed in the position in the cabin (which must be at least 1.4 meter high and 0.6 meter wide) which would be occupied by the corresponding passenger. and (2) 200 kilogs. of merchandise arranged in a space of at least half a cubic meter. The sand and the merchandise will be officially sealed.

Nine days will be devoted to the competition, arranged in three periods of three consecutive days. These have been arranged as follows: February 20, 21 and 22, March 20, 21 and 22, April 20, 21 and 22. The machines must be at the starting-place on the evening preceding the start and entries must be made to the Aero Club of France eight days before the start of each test.

New Minister for Aeronautics in France

With the fall of the Cabinet of M. Leygues last month. M. Flandin, the Under-Secretary of State for Aeronautics, has been replaced in his office by M. Laurent Eynac. By his keen devotion to the advancement of aeronautics, M. Flandin has earned the gratitude of all engaged in the industry. His successor, M. Laurent Eynac, is the proprietor of the well-known French paper, *L'Air,* and in that capacity has also done much useful work.

Grand Prix de l'Aero Club de France

Entries for the above competition closed on January 15th and the following names have been notified to the club:

1. Nieuport (Sadi-Lecointe). 2. Bréguet (Roget). 3. Bréguet (X..). 4. Caudron (X..). 5. Farman (Jean Bernard). 6. Farman (d'Or). 7. Blériot (de Romanet). 8. Blériot (Casale). 9. Potez (Douchy). 10. De Marcay (Benoit).

Schneider Cup

The date of entry for this year's contest has been extended to June 1st. In addition to the entry fee, the entrant has to deposit 5,000 francs per machine as a guarantee of the machine taking part. This deposit is returned in respect of all machines taking part in the contest.

The contest is divided into three tests:

1. *Watertightness Test.*—For this test the machine must remain afloat for 6 hours, with a full supply of petrol and oil for the whole contest.

2. *Navigability Test.*—For this test the machine must fly in a closed circuit over a course of 5 to 10 sea miles. During this test the machine must be taxied on the water over two distances of half a mile.

3. *Speed Test.*—The speed test will be contested over a distance of 200 sea miles in a closed circuit of a minimum distance of 5 sea miles.

Any repairs necessary after the contest has started may only be carried out at sea, but these repairs must not modify the original condition in which the machine was presented.

Competitors not carrying out the navigability test satisfactorily may start again for a second and last attempt.

The date has been provisionally fixed for September 30, 1921.

Sadi-Lecointe Honored

Sadi-Lecointe, the French airman, who won the Gordon Bennett Cup for France last autumn and afterwards created various world speed records, has been made Chevalier of the Legion of Honor.

French Aeroplanes Against Tribesmen

Paris.—A telegram from Budenib, on the Morocco-Algerian frontier, reports that local levies, assisted by French aeroplanes, attacked and routed, with considerable loss, a large gathering of rebellious tribesmen southeast of Itzer.

The Aero Club of South Africa

The affiliation of the Aero Club of South Africa with the Royal Aero Club has been approved and the agreement signed.

German Aero Clubs Combine

A Berlin correspondent reports that the Aero clubs of Kurhessen, Gross Thuringen and Saxony have combined to form a national aviation society. The inaugural meeting took place at Cassel in Prussia, and was largely attended by delegates from many district councils and representatives of important manufacturing and commercial interests. It was unanimously resolved to adopt a resolution pledging the members to prevent by all possible means the investment of foreign capital in German air transport companies. The headquarters of the new society is at Cassel, which city has already provided a landing place for German aeroplanes.

Aeroplanes Directed by Radio

It is reported that a French inventor named Detables, has succeeded in getting financial support which it is believed will enable him to perfect an invention he has developed of an aeroplane which can be directed without a pilot over long distances by means of radio telegraphy, much on the same principle as that employed for the direction of seagoing vessels by John Hays Hammond, Jr. In the early days of November, 1918, the inventor claims he succeeded in guiding the apparatus at a height of 700 meters for a distance of nearly 125 miles, and he believes he can extend the scope of his aeroplane's flight area to at least 500 miles without a pilot.

Fédération Aéronautique Internationale

A meeting of the Bureau of the Fédération Aéronautique Internationale was held in Paris on Monday, January 10. Prince Roland Bonaparte was in the chair, and representatives from the following countries were present:—America, Belgium, France, Great Britain (Lieut.-Col. Mervyn O'Gorman, C.B., and H. E. Perrin), Holland, Italy, Sweden, Switzerland.

Shanghai-Peking Air Mail Service

It is hoped that a tri-weekly air mail service from Shanghai to Peking will be started on May 1.

Aerial Derby Around the World

The draft regulations drawn up by the Aviation Commission of the Aero Club de France were presented at a meeting of the Committee of the Royal Aero Club on Wednesday, January 12, but it was decided to defer their consideration until they had been submitted to the Aero Club of America.

The Hong Kong Aero Club

At a recent meeting of the Hong Kong Aero Club the chairman, Hon. P. H. Holyoak, read the following from a report setting forth the objects of the club:

1. To encourage and develop the sporting side of aviation in the Colony.

2. To take control, when necessary, of the sporting side of aviation in the Colony.

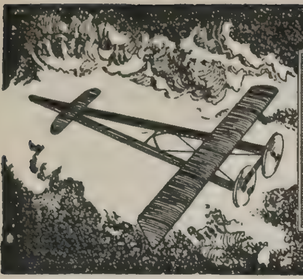
3. To affiliate with the Royal Aero Club and to act as the official representative of that body in the Colony.

4. To request the Government to allow an area of water to be definitely chosen for the landing of aircraft in the vicinity of the town when necessary and to have the site left clear and available for the machines when necessary.

5. To appoint a committee to deal with the following matters: Technical, such as assistance to arriving and departing aircraft and dissemination of information on the conditions governing flying around the Colony, and also to reply to the letters sent to the government by the Aero Club of America, and to give assistance and advice to members who desire to purchase and use aircraft.

Reports of German Treachery

A dispatch to the *Daily Mail* from Antwerp says the aeroplanes which the Germans are surrendering to the Interallied Aeronautical Commission are reaching Antwerp in disgraceful condition. Essential parts are missing, making impossible the reconstruction of the machines. It is alleged that the aircraft are being systematically damaged in order to hide constructional secrets.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

CLUBS

PACIFIC N.W. MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.
BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn
INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana
BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.
TRIANGLE MODEL AERO CLUB
Baltimore, Md.
PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska
BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.
ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.
SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana
MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.
MODEL AERO CLUB OF OXFORD
Oxford, Pa.
CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.
AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City
AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.
LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

New Model Aeroplane Club at Kelly Field

To increase the morale and interest of the students of the A. S. Mechanics School at Kelly Feld, Texas, a model aeroplane club is being formed, in the course for aeroplane mechanics. The instructors and students are taking an active part. Several excellent models have been built, and some very good straight-away and circular flights have been made. Standard distance models and scale models are under construction. The greatest stress, however, will be laid upon scale flying models of service planes.

The students will have every opportunity to test their rigging ideas on these tiny ships. It is thought the information derived from this source will be very beneficial. This work, of course, is being carried on during the men's spare time. In the evenings, when the air is steady, the flying field presents an animated appearance with these pigmy ships flying about. Later in the season model contests are to be held and trophy cups awarded.

Southerner Builds Air-Propelled "Speed Wagon"

Mr. R. E. Lee has startled his townspeople by driving through Rocky Mount, N. C., in a vehicle of his own invention, a "wind wagon" driven by a direct drive propeller.

The machine is built to accommodate two persons seated in tandem, with the engine and radiator located as in an automobile, but raised higher to permit the tractor propeller to swing. On city streets a speed of 40 miles an hour was attained on its initial trip, resulting in Mr. Lee's arrest for speeding by a policeman, who remarked: "If you're going to fly in that you'd better get out in a field to start."

The running gear consists of four cycle car wheels on ball bearings. Tread 48". Wheel base 100". Axles are coupled up with one inch rods, on which the body is built.

A remodelled Ford engine is installed. It is provided with light pistons and crankshaft counter balances. For lubrication a rotary oil pump is located at the rear end of the cam shaft. Revolutions of the engine vary from 1,200 to 1,400 per minute. About 30 is developed. The propeller, manufactured by the Heath Company has a 3½ foot pitch and is 5½ feet in diameter. It is driven directly from the crankshaft.

A Method of Finishing Model Propellers

Some notes concerning the method of finishing model propellers for testing purposes is contained in a report given out by the National Advisory Committee for Aeronautics. The propeller tests were made at Leland Stanford Junior University, Palo Alto, Cal. The method of finishing can be adapted with good effect to the needs of model builders, and should be particularly desirable for finishing scale model propellers where fine balance is one of the essentials.

Pacific Coast sugar pine was used for the propeller blanks. After carving and sandpapering, the smooth bare wood is given a coat of orange shellac. This is rubbed with fine sandpaper, and the surface given three or four coats of flat gray paint put on very thin with a camel's hair brush. Each coat should be thoroughly dried and rubbed smooth, small surface defects being corrected with wood filler. The propeller is then given two coats of rubbing varnish, the first coat being rubbed with pumice and water, which leaves the propeller with an egg-shell finish and the second coat applied and left glossy. The resultant finish is smooth, thin and hard.

Models Built by "Aerial Age" Readers

Mr. William R. Kinkelman, 11th and Buffalo Streets, Franklin, Pa., has completed a realistic model of the Curtiss JN-4B Training plane, built from drawings which appeared in Aerial Age some time ago. Mr. Kinkelman has been an interested reader of Aerial Age for several years.

A very neat scale model of the Curtis JN4H has been built by Frederic L. Trump of Minneapolis, Minn. This model is now in the possession of the Aero Club of Minneapolis. Last winter Mr. Trump won a first prize in a contest given by the Club, with an Italian Ansaldo I model.

Propellers May Be Made Moisture Proof

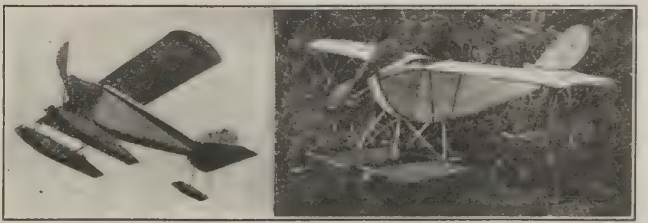
One of the principal drawbacks of wood propellers up to the present time has been their tendency to absorb moisture, causing the blades to warp. This undesirable feature persists even though the propeller is carefully finished with several applications of wood filler ad varnish . Many attempts have been made to render wood propellers waterproof but it is only recently that such efforts have met with any marked degree of success. A process of applying aluminum leaf, in much the same manner as gold leaf is put on store window signs, has been found to give excellent results, provided the propeller itself is properly prepared before application of the aluminum leaf. The latter also must be applied with care, after which a good enamel and varnish finish is added. Tests have shown that propellers so treated are practically moisture proof.

Constantine Model Aeroplane Club Formed

Model builders in the region of Constantine, Michigan, are invited to join a new Model Aeroplane Club which has just been organized to promote a general interest in aviation in its own radius of country. Models and gliders will be constructed and prize contests arranged. It is planned to hold debates, give lectures and discuss aircraft development. Members now enrolled are: Arthur Machemer, Arol Greensules, Harold Dittman, Cecil Stears, and the director of the Club, C. S. Jones, to whom all correspondence should be addressed.

Pacific Model Aero Club Activities

Mr. Raymond C. Hansen makes a report that the Pacific Model Aero Club is still quite active and going stronger than ever, proved by the fact that the Club now has a Portland branch. The Pacific Club is endeavoring to enlist the new Pasadena Model Club in a chain which they are organizing and which will be composed of all the Model Clubs on the Pacific Coast. Detailed reports of this move will be made at a later date together with notes of recent activities in model building.



Loening Seaplane Model Built by Edward Walker, Rockwell, Texas

A-E-R-O-N-I-T-I-S

Those Who Fly

Ah, what joy to Fly!
Way up here in the sky,—
The wonderous World below—
Town, bay, and hill,—smaller grow.

Oh, what delight!
In airy flight—
'Round about,—commanding sense,
Visual ranges—a strange suspense.

A thrill to Life!
Devoid of strife;
Serene, and nearer God to be,—
Close kinship to Eternity.

Yea, those who fly must Trust,
In Something more than common clay and dust!
Copyright, 1921, *by Charles L. Pyral.*

A Verse

The flying fish was flying and as he flew and flew and flew
The wind about him blew and blew and blew
The bird above him soared and soared and soared
And the man in the boat below him snored and snored and snored.
The dog fish chased the cat fish round and round and round.
And the busted aviator slept calmly on the ground.

Then He Went Up in the Air

MANDY—"Rastus, you all knows dat yo remind me of dem dere flyin' machines?"

RASTUS—"No, Mandy, how's dat?"

MANDY—"Why becays youse no good on earth"—*Sun Dial.*

At Early Dawn

From the great high tower, at early morn:
I see the sun come up at dawn,
I see the stars go home to bed.
I hear the sea gulls overhead;
And then the flag goes up:
Which means for men to fly.
I hear the purr of a motor, she's on the step,
Then like a bird the seaplane passes by.
Up, up like a swift winged swallow
Up, up into the big blue sky.
Still they come, still they follow,
Men like birds learning to fly.
Across the bay, the bay so blue
Up, up in the cloud like dew.
She looks so silvery, sparkles bright.
A spiral, a dip and then a glide,
Then she touches the water light.
All day long they come and go;
Each man takes his turn,
There is so much to learn.
A cross wind test: then up, up they go
To shoot the boat:
Within a hundred feet of its side.
Then she touches the water light,
Taxis about, across the tide
And back to the hangar for the night.
Elizabeth Ashmead Cantwell.

The new roof landing net enables the aviator to land upon the roof without the slightest fear of falling off the other end. Should the speed of the aeroplane prevent its landing within safe limits it merely rolls off the edge and lands in the net, as illustrated, a very simple matter

Why He Was Apprehensive

Sandy McTavish was a highly-skilled workman in a new aircraft factory.

Therefore, it happened one day that Sandy was asked if he would care to accompany the works aviator on one of his trial flights in a machine.

Sandy, after some hesitation, agreed to do so.

During the flight the aviator asked how he was enjoying it.

"To tell the truth," answered the Scot, "I wad rather be on the groun'."

"Tut, tut," replied the flying man. "I'm just thinking of looping the loop."

"For Heaven's sake don't dae that!" yelled the now very nervous McTavish. "I've some siller in my vest pocket."—*Tit-Bits.*

Essential

The novice was not enjoying his first trip through the air and his more experienced companion regarded him in some amusement.

"I say, Bill, what's on your mind?" he demanded.

"I was just thinking about Abraham Lincoln," replied Bill thoughtfully.

"Abraham Lincoln?"

"Yes. I was thinking how truthfully he spoke when he said a man's legs ought to be just long enough to reach the ground."

Wail of the Permanent K. P.

I know nothing of "dihedrals" or of struts or rigging wires,
For all I know the "crankshaft" is contained within the "tires."
And "stagger," "fin" or "aileron" are surely Greek to me,
For since I joined the service I've been busy on K. P.
In aviation I enlisted and I thought I'd learn the game,
But ever since that fatal day I've never been the same,
For they disregarded aeroplanes when they picked a job for me
And I'll never learn of "longerons" or "bay struts" on K. P.
The only "dope" I know about is what they put in stews,
If I had to find the "fuselage," the job I would refuse.
I wish they'd fix a "landing gear" so it would work for me
And let me grab a "joy stick" that would land me off K. P.
I've never had to "rig" a plane, or tried to swing a "prop,"
I've never cleaned a "spark plug," and I've never rode a "Sop."
When the boys are talking "enpenage," no sense in it I see;
It means nothing in my young life, for I'm a permanent K. P.
—J. C. McD., *Flyleaf.*

Forbidden!

One of the guards had been showing a party of visitors about the aerodrome and an elderly lady, after thanking him for his kindness, remarked:

"I see that, according to the Post's orders, tips are forbidden."

And the soldier, turning to the visitor with a knowing look, answered: "Why, bless you, ma'am, so were apples in the Garden of Eden."

To the Reader

"We are at the opening verse of the opening page of the chapter of endless possibilities." So wrote Mr. Rudyard Kipling recently on the future of aircraft. The progress achieved since December 1903 has certainly been phenomenal and the plans that are maturing during the present year promise even greater possibilities The importance of these developments is so great and their results may have such far-reaching effects that you cannot afford to be without the fullest information. You can keep closely in touch with all the latest developments at home and abroad by placing your name on our mailing list. It only costs you $4.00 a year (Foreign $6.00) and you can then rely on receiving, regularly each week, all the latest news and technical information. Shall we add your name—today?

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A Remarkable Flying Record

Predominant among records at flying in the United States on file with the Northwestern Flying Club, is that of Lieut. John Earl Fladeland, of Portland, North Dakota, who, over a period little short of four years, has flown 2,592 hours over territory of every nature with not a single accident and without breaking as much as a propeller or tailskid. It is a remarkable demonstration of consistency and efficiency in the every day use of aeroplanes.

In 2,374 hours of professional civilian flying 3,078 passengers were carried, 216 exhibition flights produced without missing a contract date, rain or shine, and approximately 115,000 miles of cross country travel were accomplished. On a speed basis of eighty miles per hour, and figuring four ascensions to the hour, the grand total amounts to 207,360 miles flown with 10,368 take-offs and landings. This is all the more remarkable in that the only established landing field used was that of Curtiss Airport at St. Paul, while the hundreds of others were scattered over the hilly, wooded, swampy and prairie sections of the Northwest, and all were selected from the air with no advance arrangements made. Numerous cross-country flights were made over long stretches of unsettled country where no suitable fields of any kind were available.

Lieut. Fladeland's record, like numerous others being reported, demonstrates that in skilled hands, with aeroplanes properly cared for, where unnnecessary hairbreadth performances are left undone, aerial travel is as safe as any of the modes now utilized. When flying is standardized and regulated by state and federal laws, and when fields with reasonable factors of safety are established over the country, aviation accidents will be reduced to a minimum and aviation will come into its own.

Employment Service for Pilots and Mechanics

Realizing the need for a clearing house for companies employing pilots and mechanics, R. E. Layman, M.E., and Capt. Archibald Johnston, R.M.A., have established a service which proposes to find positions for competent aeroplane crews and to furnish skilled and reliable pilots and mechanics for operators of commercial aircraft.

Captain Johnston has found that it is very difficult to get in touch with the right type of man for commercial flying, and that there is a real need for an organization which can thoroughly investigate and recommend pilots and mechanics. His five years' experience in commercial and military aeronautics indicate that many accidents could be avoided by the careful selection of operating personnel. The Aero Service Company is the result.

Doctor Uses Aeroplane

In a recent conversation with Dr. W. S. George, County Health Officer of Contra Costa County and the most prominent physician on Antioch, he said that he is having his emergency Therapeutics delivered by aeroplane. The Western Laboratories of Oakland will make up any Therapeutic on a moment's notice and have it delivered to your patient in a matter of minutes. The doctors are becoming educated to the use of the aeroplane and more doctors should follow the footsteps of Dr. George, who is far the most advanced to modern ideas in his line in the country.

Aeroplanes in Forestry

Toronto.—The use of hydroplanes and aeroplanes in modern Canadian forestry was one of the subjects discussed at the fall meeting of the Woodlands Section of the Canadian Pulp and Paper Association, held at the King Edward Hotel on Wednesday and Thursday, December 8th and 9th. The Laurentide Company, Ltd., of Grand Mere; Price Bros. & Co., of Quebec, and the Spanish River Pulp and Paper Mills, of Sault Ste. Marie, Ont., are all employing aeroplanes in fire patrol and photography work, and their operatives contributed to the discussion.

Yolo Fliers' Club

The Yolo Fliers' Club, San Francisco, at the annual meeting laid plans for the expenditure of close to $125,000 during the coming year. The plans include the construction of golf links, swimming pool, first unit of a clubhouse, two hangars and a reservoir. To date the club has purchased 617 acres, constructed a landing field, drilled a perpetual water supply well, laid out a golf course and beautified the approach to its ground. There are 359 members.

Sir Arthur W. Brown on a Mission to the Orient

Sir Arthur Whitten Brown, navigating pilot on the Transatlantic flight with the late Sir John Alcock passed through British Columbia recently, being feted by all centers. He stated that British Columbia was ideal for aviation, and more especially for water landing craft. He is on a mission to the Orient for investigating conditions there on behalf of English associates.

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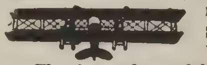

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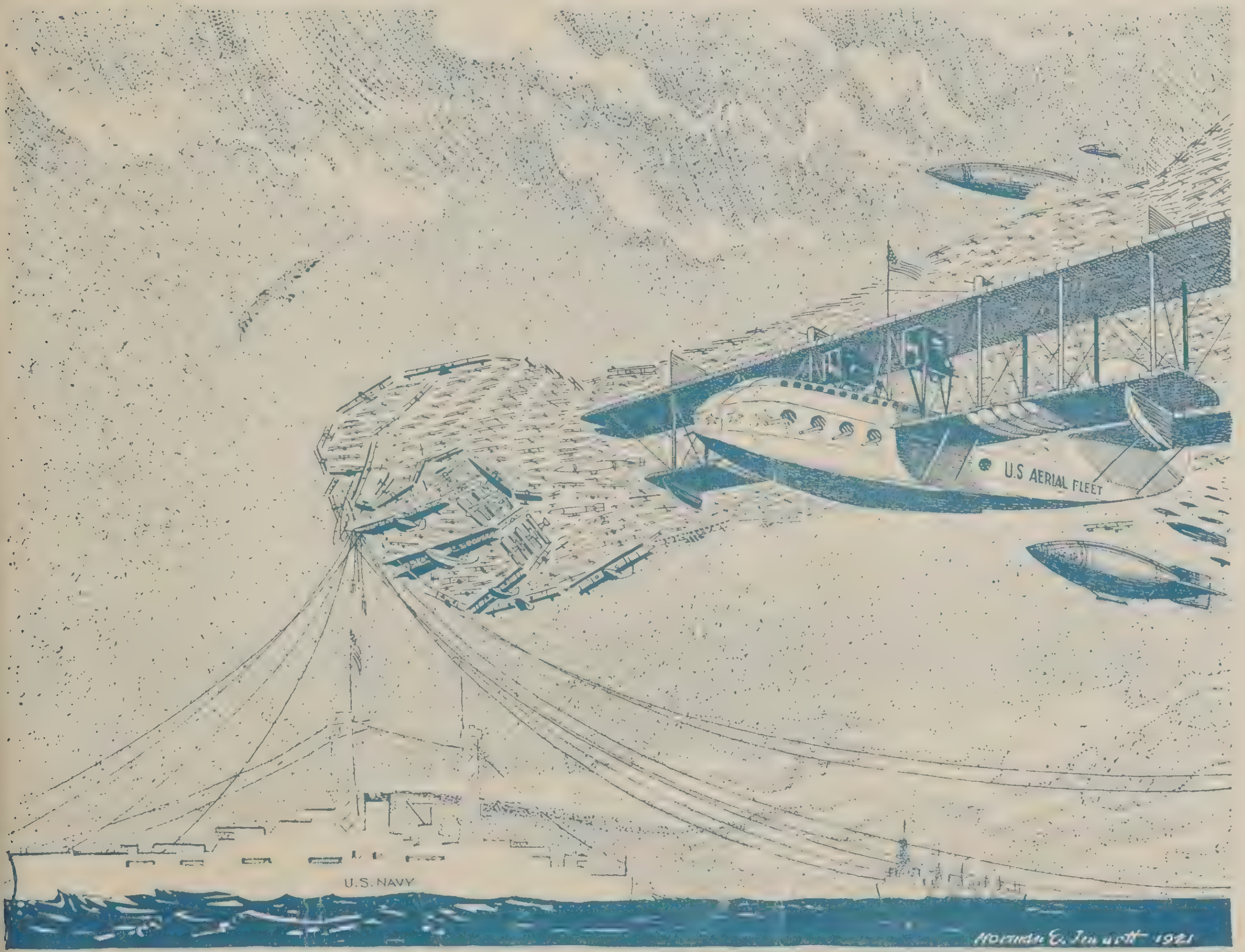

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THE NAVAL CONTROVERSY

THE intimation that the former German dreadnought battleship Ostfriesland will be used as a target for explosives to be dropped by an aeroplane will be welcomed by naval officers who believe that the high-speed aeroplane carrier is to be a formidable unit of the fleet. It is also to be hoped that a Martin torpedoplane will be given an opportunity of demonstrating its effectiveness.

Unless all signs fail, Congress will authorize the construction of two or four of aeroplane carriers. There are Admirals of the navy and eminent retired officers who maintain that battleships no faster than our newest types in commission would be at the mercy of a squadron of aeroplane carriers having a speed of, say, thirty-five knots and equipped with torpedo and bombing planes. The carriers, while keeping out of gun range, could dispatch planes to attack the battleships, whose only means of defense would be anti-aircraft guns. Partisans of the capital ship contend that it would always be possible to beat off aeroplanes by gunfire, but the effectiveness of anti-aircraft defenses as demonstrated during the war does not bear them out in this contention.

It is to be regretted that the air services of the army and navy are not so well prepared as might be wished—as the British, according to recent dispatches, have shown, for instance, that they are—to demonstrate the destructive power of the plane and the vulnerability of the battleship. Too much stress should not be laid upon a high score by the aviator in hitting the mark. It has already been shown that dummy bombs can be dropped with a fair degree of accuracy upon a stationary ship. Upon a ship under maximum speed some hits should be made and a torpedo dropped on the deck would disable a battleship, if it did not sink her.

The idea that the aeroplane must drive along at an altitude of several thousand feet to operate at all is not tenable. It has been shown in manoeuvres in British waters that skirmish planes can drop smoke bombs above a battleship as a screen for the high speed torpedoplane to protect it from gunfire. Rushing down upon the battleship at more than a hundred miles an hour, the torpedoplane can get close enough to launch its explosive with comparatively little risk of being hit by the gunners, who, at the best, could fire only a chance shot as the plane darted from the smoke cloud. If the American aviators selected for the test are previously trained in using smoke bombs, it should be possible to improve upon the British experiment.

The deck protection of the Ostfriesland, which is a ship of 22,500 tons displacement, length 546 feet and beam 93½, was not given in Brassey's Naval Annual of 1915, but it is probably 3 inches. The belt thickness is 11¾ inches and the turrets are well protected. The great question to be settled is whether an aviator can score direct hits on a moving warship. Specialists who have made a study of the matter entertain no doubt of it. If the Ostfriesland can be disabled or sunk, the new and better armored Tennessee would also be vulnerable, for the power of the explosive could be increased. As to keeping off the torpedoplane by gunfire, that would be the last argument of the capital ship partisan, and a weak one.

The test to be made on the Ostfriesland we hope will be arranged for at the earliest possible date, and we are confident that Secretary Daniels will no longer boast that he would be willing to navigate a battleship if he merely had to contend with aeroplane bombs. We venture a guess that the Secretary's desk in Washington would be a safer place, than the deck of a battleship under bombardment by aircraft dropping bombs and aerial torpedoes.

Flying Freight

LESS than two decades ago Professor Langley, of the Smithsonian Institution, launched from his pier over the Potomac the airship upon which he had been working for years. The ropes became tangled in the wheels, the machine hovered in the air for a moment and then plunged into the river. The world laughed. The art of flying, it was almost universally thought, was still a matter for the distant future.

Yet today the aeroplane has become a recognized part of modern civilization, and the whirr of the propeller as it passes over city or farm creates no more than passing interest. In war the heavier than air machine has proved its utility, both as a scout and for offensive purposes, and at the present moment expert authorities are at odds over the ability of the battleship to avoid its deadly attacks.

But now that the thunders of war have died out on the battlefields of Europe, the aeroplane and the dirigible are rapidly coming into use as carriers of freight. It is announced that during 1920 goods to the value of £1,000,000 were brought into or exported from the British Isles by the air service. The articles handled were clothing, furs, watches, paintings, moving picture films, wireless apparatus and other light commodities. A truly remarkable record this, a record which promises great things for the future. The age of commercial air transport is no longer a thing to which we must look forward, for it is already here.—*Editorial in N. Y. Sun.*

THE NEWS OF THE WEEK

Asks Naval Ships for Aeroplane Targets

Washington.—A joint resolution directing the Secretary of the Navy to place at the disposal of the Air Service of the army certain obsolete naval vessels, and directing the chief of the Air Service to conduct extensive tests to further the development of aerial attack on seacraft, was introduced in the Senate February 12th by Senator New of Indiana, a member of the Committee on Military Affairs.

The preamble to the resolution points out that during the World War the possibilities of aircraft were demonstrated, and that, owing to present economic conditions, appropriations should be allocated in such manner as to produce the most effectual provisions for the national defense, and therefore a study of the effect of aircraft against seacraft should be made. It is pointed out that the experiments are justified since, up to the present, no missiles actually have been dropped from aircraft upon seacraft to ascertain the effects of such missiles on naval and other vessels.

The resolutions concludes:

"Whereas, the future policy of development of aircraft and seacraft may be radically changed as a result of these experiments, therefore be it resolved by the Senate and House of Representatives in Congress assembled that the Secretary of the Navy be, and he is hereby, directed to turn over to the Air Service of the Army one obsolete battleship, two obsolete destroyers and two obsolete supply ships, or their equivalents, to be used for the purpose of serving as targets for the development of aerial armament and methods of aerial attack against seacraft."

"And, further, that the Chief of the Air Service of the Army be directed to conduct such tests of aircraft attack against the seacraft thus turned over as may be necessary in the development of aerial armament and methods of attack against seacraft."

The resolution was referred to the Committee on Naval Affairs.

Famous French Ace Arrives

Among the passengers who arrived recently from Paris on the French liner *France* was Captain Nungesser, the French ace, who has been credited with bringing down forty-three enemy planes in flames and forcing down forty more machines.

Although he had been wounded seventeen times and has a platinum lower jaw, a platinum knee and a foot made of the same metal, he looked perfectly sound as he tripped lightly down the gangway wearing the light blue uniform of the French Army Aviation Corps, with fourteen medals and decorations upon his breast, including the Legion of Honor, Medaille Militaire, Croix de Guerre with thirty citations, and two stars. He said that he was proudest of the two stars because he had earned them when serving in the infantry early in the war.

Nungesser, who is 29 years old, comes as the guest of the Aero Club of America, and was met at the pier by a delegation of the members, and while here he will introduce to the Government-owned or private concerns certain inventions he has perfected.

He was accompanied on the trip by the Marquis de Charette, who is a grandnephew of former President James K. Polk, and who said he was going to Tennessee to confer with engineering concerns which he represents in France.

First Hall "Vertical Lift" Aeroplane for Mexico

Mr. P. M. Snyder, president of the Mexico Lands & Engineering Company, has placed an order with the Hall Aeroplane Co., of Los Angeles, Cal., for one of their latest type vertical lift aeroplanes.

It will be interesting to the aircraft trade in general to learn that while this first plane will be used in experimental work, it is the intention of Mr. Snyder to demonstrate it to the Secretary of War of the Mexican Government and Mr. Hall of the Hall Aeroplane Co., has been given every assurance that if these tests bear out the claim he has made for this ship, the Mexican government will, no doubt, be interested to the extent of fifty or more of this type.

It has been pointed out by Mr. Snyder, that the revolutionary features and particularly that of the vertical lift, if successful, make this plane ideally suited to a rugged and mountainous country like Mexico. This plane is readily adaptable to industrial as well as war time usage and the tests will be watched with interest by all those interested in the development of aviation.

For years Mexico has been harassed and pilaged by banditry and the mountainous country has made it almost impossible to apprehend these outlaws. However, with the coming of the aeroplane and especially of a type capable of taking off and landing in a smaller space than present types of aeroplanes, the problem seems near solution.

This first ship is now under construction at the Los Angeles factory of the Hall Aeroplane Co., and its progress will be announced from time to time in this magazine.

Burleson Defends Junker Plane Use

Washington.—Responding to a House resolution demanding information relating to purchases of Junker aircraft, Postmaster-General Burleson advised the Congress that Junker planes have demonstrated their efficiency and economy in actual demonstrations.

The Postmaster-General said:

"The Junker aeroplanes purchased by the Post Office Department represent a forward step in aeroplane development over the development at that time in this country. Their operation over 30,122 miles gives 5.1 miles per gallon of fuel, as against an average of about 2.5 miles per gallon with the planes and motors in the air mail service. The cost of flying operations with these planes is about 30 per cent less and the cost of maintenance and upkeep about 50 per cent less than is the flying cost and maintenance cost of the Liberty motored De Haviland planes turned over to the Post Office Department by the Army and Navy.

"On the other hand, the cruising radius of the Junker plane is at least 50 per cent more and the possible mail load is nearly two and one-half times as great as that of the surplus war planes with which the air mail is principally operated. Whether the relatively low cost of maintenance of a Junker plane over a De Haviland will continue as the planes see more service is something that is being determined by the daily operation of these planes by the side of the De Havilands.

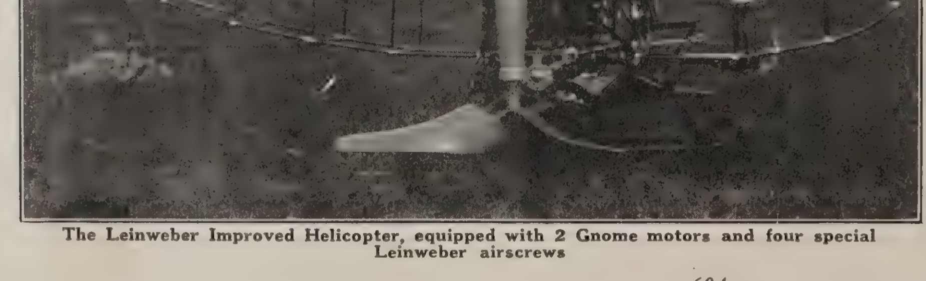
"When the German planes were put into service by the Post Office Department, after planes of this type had made a number of remarkable long-distance runs for other parties, defects in the fuel installation and in the engine compartment, ventilation and drainage were discovered through planes catching fire in the air.

"These defects of construction and engineering were promptly remedied by the Post Office Department, since which time the planes have been operating steadily in the mail service without fire hazard or casualty of any character to the crews operating them. The safeguarding against fire hazard, as the result of the accidents to the Junker planes, has been of great importance to aviation and has resulted in the elimination of fire hazard in other mail ships."

Actually, the Post Office Department bought eight Junker planes, for spare parts to the value of two additional planes were obtained to keep the other six machines operating.

Successful Aero Meet at the Marina, San Francisco

A very successful aviation meet was held at the Marina on 23rd January,



The Leinweber Improved Helicopter, equipped with 2 Gnome motors and four special Leinweber airscrews

where a crowd, estimated at from 8,000 to 10,000 was attracted to watch a display of "stunt" flying and aerial competitions.

Twenty-five machines were entered for the various events and the whole program was carried out without a hitch or accident of any kind.

Walter T. Varney, "Hal" Bruntsch, W. P. Johnson, Colonel H. H. Arnold and Lieutenant Halvorsen of the Army Air Service, acted as officials of the meet.

In the thirty-five mile race, five machines participated, and the winner was Flying Cadet Woodgard in 9 minutes 55 seconds. The others finished in the following order: Cadet Guile, 11:15; Cadet Heyer, 11.20; Cadet Robbins, 11:25, and F. P. Clevenger, 11:25.

Ruler of Mardi Gras Arrives by Aeroplane

New Orleans.—Through streets decorated with bunting and banners, Rex, ruler of Mardi Gras, rode with his Queen today, the parade bringing to a climax the public festivities incident to the annual carnival celebrations.

Rex, more modern than usual, arrived at the royal reception rooms from a seaplane, the usual trip up the river having been done away with.

Another Helicopter

Recent reports from Paris indicate that fresh progress has been made in the development of another Helicopter. The inventor on this occasion is Marquis Raoul Pateras Pescara, of Argentine birth, who has been conducting experiments at Barcelona. So impressed are the French War Office with his progress, that it has bought the exclusive rights to use his machine—so the reports state. In an interview, the inventor makes the following observations.

"A great mistake has been made in trying to make a helicopter machine which worked like an aeroplane with the engine stopped. My plan is to compromise the vertical movement with a longitudinal movement. I have obtained two essential results which mean the solution of the problem—descent and landing.

"My machine can descend by leaving the propellers free to revolve and their resistance makes the machine come down like a parachute. As for the necessary motion in landing, that is accomplished by changing the angle of the propeller blades.

"The machine is an automobile which flies. The body has the form of an automobile. The upright from the motor bears two sets of propellers which revolve in opposite directions. The height of the machine is about 10 feet and its weight is 700 kilograms. I have established stability in every direction, both vertical and longitudinal.

"This machine is capable of a speed of 100 miles per hour. I am going to build a machine which will fly faster than the swiftest aeroplane, with which I hope to win the next Michelin race. But that is for the future."

M. Painlevé, former Premier of France and one of the foremost scientists, is expected shortly to read a paper before the Academy of Sciences on Pescara's machine.

Wilson Agrees Aviator Was a Spurious Hero

Washington, Feb. 10.—After having the case before him since November, 1919, President Wilson today approved the dismissal from the United States Marine Corps of Captain Edmund G. Chamberlain, of San Antonio, Tex., who was found guilty of "falsehood" and "scandalous conduct tending to the destruction of good morals" by a general court-martial in London in May, 1919.

Chamberlain was brought before the naval court-martial after he had related a picturesque tale of his alleged exploits as a volunteer with a British aerial group in France. According to the story credited to Chamberlain, he was invited by a British officer to visit an aerodrome within the British lines, and there made a flight, during which he declared he successfully brought down several enemy planes and saved himself from capture by clever handling of his machine. The fantastic tale credited to Chamberlain also had him rescuing a British colonial soldier who was wounded.

UNITED STATES POST OFFICE DEPARTMENT AIR·MAIL SERVICE

Monthly Report of Operation and Maintenance, December, 1920

													SERVICE AND UNIT COST					
DIVISION	Gas.	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Pilots	Mechanics and Helpers	Departmental Overhead Charge	Interest on Investment	TOTAL	Gallons of Gas.	Total Time Run	Total Miles Run	Miles Run per Gallon of Gas.	Cost per Hour	Cost per Mile
New York-Washington..	$2,057.59	$380.69	$5,237.21	$1,383.21	$1,252.17	$616.74	$1,081.34	$1,177.69	$3,426.29	$241.85	$688.75	$17,545.24	5,475	hr. mn 138 10	10,934	2.0	$126.99	$1.60
St. Louis-Twin Cities..	2,621.89	596.13	2,747.44	3,429.23	975.61	525.46	2,434.30	2,691.83	4,369.84	725.59	1,291.18	22,408.70	7,282	272 27	17,122	2.4	82.26	1.31
New York-Cleveland....	2,496.61	392.98	2,440.94	3,897.24	681.31	618.75	1,921.29	2,236.69	2,948.57	483.72	1,402.92	19,523.02	6,912	206 52	14,471	2.1	94.37	1.35
Cleveland-Chicago.....	1,900.54	415.50	748.16	1,947.38	454.11	233.61	1,448.14	1,982.55	1,520.30	362.79	501.67	11,514.75	5,360	116 22	13,682	2.6	98.95	.84
Chicago-Omaha......	1,302.44	299.22	1,230.50	1,616.31	400.14	125.29	1,211.20	1,654.80	1,809.27	483.72	1,043.34	11,176.23	3,794	170 48	15,916	4.2	65.43	.70
Omaha-Salt Lake....	4,715.00	1,137.55	164.19	3,804.94	720.73	482.96	1,968.34	3,645.99	3,520.10	1,007.75	476.67	24,662.22	13,220	409 26	35,103	2.7	60.19	.70
Salt Lake-San Francisco	2,691.33	591.97	5,504.02	5,445.83	715.55	352.22	2,245.48	2,424.52	2,969.63	725.58	726.67	24,395.80	7,801	255 23	23,812	3.1	95.53	1.02
Totals and Averages....	$17,783.40	$3,814.04	$21,072.46	$21,529.14	$5,199.62	$2,954.73	$12,310.29	$15,816.07	$20,564.00	$4,031.01	$6,131.20	$131,205.96	49,844	1,569 28	131,040	2 6	$83.60	$1.00

Planes operated on New York-Washington Division:
Curtiss R4's, equipped with Liberty 12 motors.
Curtiss JN4D, equipped with Curtiss OX5 motors.
Used for testing pilots.
De Havilands, equipped with Liberty 12 motors.

Planes operated on St. Louis-Twin Cities Division:
Standard, equipped with Hispano-Suiza motor.
Curtiss JN4H's, equipped with Hispano-Suiza motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Martin, equipped with two Liberty 12 motors.

Planes operated on New York-Cleveland Division:
Curtiss R4's, equipped with Liberty 12 motors.
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on Cleveland-Chicago Division:
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Martin, equipped with two Liberty 12 motors.

Planes operated on Chicago-Omaha Division:
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Junkers J. L. Larsen, equipped with B. M. W. motors.

Planes operated on Omaha-Salt Lake Division:
De Havilands, equipped with Liberty 12 motors.

Planes operated on Salt Lake-San Francisco Division:
De Havilands, equipped with Liberty 12 motors.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington..........	$0 36	$0.33	$0.92
St. Louis-Twin Cities............	.35	.35	.61
New York-Cleveland............	.35	.36	.64
Cleveland-Chicago..............	22	.31	.31
Chicago-Omaha................	.21	20	.29
Omaha-Salt Lake...............	.13	.27	.30
Salt Lake-San Francisco.........	.20	.24	.58
Entire Service..................	$0.23	$0.29	$0.48

Average cost of daily service..................................$1.00 per mile
Damage through crashes, etc., based on million mile operation.. .34 per mile
TOTAL COST, including overhead, direct operations, interest and all losses..................................$1.34 per mile

OTTO PRAEGER Second Assistant Postmaster General

The AIRCRAFT TRADE REVIEW

Passenger Planes Carry 115,163 in U. S. in Year

Passenger aeroplanes carried 115,163 persons 3,136,550 miles in this country last year, according to a report issued by the Manufacturers' Aircraft Association. These figures are based only upon the 425 aeroplanes that were reported to the association. The statement says:

"In the absence of any Federal registration, air laws and government methods for tabulating the ownership and performance of aircraft, it has been found difficult to trace the actual total number. The totals are based on questionnaires distributed by the association, but due to the itinerant nature of much of the flying it has been difficult to trace and record more than half of these. This one-half—eighty-seven companies or individuals—are located permanently in all parts of the United States.

"Much of the mileage was made on short flights of ten to fifteen miles, for which an average fee of $12.50 was charged. An increasing demand for aerial transportation between cities has been noted, the average charge for this service being 65 cents a mile. On practically all intercity flights baggage or freight was carried, the quantity limited only by the capacity of the craft. This business aggregated 41,390 pounds."

Pescara Helicopter Passes Tests Satisfactorily

The first official trials, before a French military commission, of the helicopter invented by Pescara, took place at Barcelona on February 2nd. According to reports received here these tests have been extremely satisfactory and the Frenchmen have the greatest confidence that the invention will go far to solve many of the present problems of flight.

"We have found Pescara's helicopter admirably constructed, so the report states, and we are certain that we shall be able to carry out all the tests intended and necessary with such a machine. All those which we have made gave us the full measure of force we expected. It is with the greatest assurance that we will continue the experiments, but we do not wish yet to try any definite flight tests. These will probably take place next month.

"What we can now state is that the construction of the helicopter is so good that the present machine gives promise of much greater chances of success than any that have been hitherto designed."

Tests of Automotive Fuels

Tests are being carried out at the Bureau of Standards on special blended fuels at the request of other government departments. Conferences have been held with members of the Fuel Research Committee of the Society of Automotive Engineers and other organizations, including representatives of the government, looking toward the formation of a definite program for the investigation of various fuel problems of interest in connection with automotive engineering practice. During a recent visit of one of the members of the Bureau's staff to Europe a special study was made of fuel conditions abroad.

Over Two Miles a Minute

Toronto.—Lieut. McLerie, who piloted an S.E. 5 in the communication service between Camp Borden and this city, covered the 60 odd miles in thirty minutes. In the return trip, with Lieut.-Col. Douglas Joy, commander of the camp, aboard, the flight was done in forty minutes against a head wind.

Flying Weather in the Southern Plains States

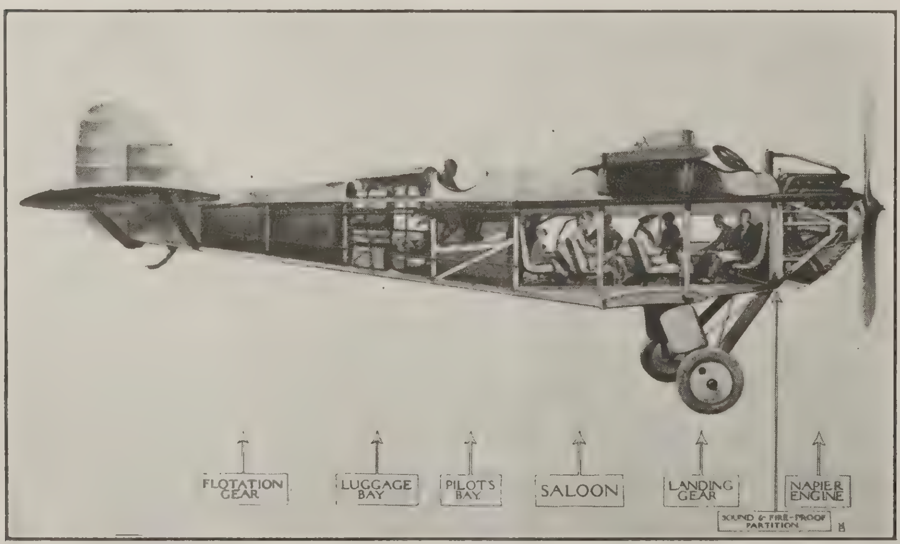
This paper appearing in the November issue of the Monthly Weather Review is a study of wind and weather as they affect the business of flying. Tables of average free-air winds have been computed for the first two years of pilot balloon observations at Broken Arrow and Fort Sill, Okla., and for one year at Fort Omaha, Nebr. The annual means are based on 1,237 observations at Broken Arrow, 1,098 at Fort Sill, and 567 at Fort Omaha. By applying to the mean velocities the mean gradients from each level to the next higher level from the surface up, discontinuities due to fewer observations at higher altitudes have been to a large extent eliminated. Average directions were computed separately by trigonometry.

Because balloon ascents are made at times when the wind is too light for kite flights, a comparison of mean velocities obtained by kites and balloons shows a slightly smaller mean velocity in summer by balloons. Another fact brought out is that the direction at high altitudes at both Oklahoma stations has a stronger northerly component in summer than in any other season.

The general eastward drift of the air at high altitudes is conspicuous at all stations; marked differences, however, occur from time to time under similar surface pressure distribution, and these differences are largely the result of abnormal surface temperatures.

Velocities in the free air are somewhat smaller over Oklahoma than at stations farther north, and this fact, together with the comparatively mild winters, is favorable for the growth of aviation in this region. Transcontinental flying, too, can be continued throughout the year at this latitude, while a considerably more northerly route would often be closed in inclement weather.

Low clouds and rain constitue the most frequent unfavorable condition for flying; fog is serious, but too infrequent to be of importance; while high winds are of intermediate importance.



Sectional view of the De Havilland 18, showing passenger and baggage accommodation. This type is used in the London-Paris service, and is available for American use through the Amerada Corporation of New York City

Mail Speeds 3,000 Miles in 2 Days

A letter mailed in Los Angeles for aeroplane transportation to New York reached its destination, a distance of 3,000 miles, in forty-eight hours, according to a report made by Government officials to Maurice Cleary, Director Governor of the Aero Club of America. The transit by train generally is five days or more.

The letter was received by J. D. Cudney, Chief of the Engineering Department of Ingersoll, Rand & Co., No. 11 Broadway. The stamp cancellation of the Los Angeles Post Office showed the missive had been mailed at 5:30 P. M., Jan. 24. It reached Mr. Cudney on January 26, and several hours later, when he realized the quickness of the time for its transit he had the hour dated by the Engineers' Club.

Officials at the New York Post Office said yesterday the night mail from Los Angeles arrives in Salt Lake City in time to be transferred to an aeroplane flying eastward shortly after daybreak every day. The letter, it is believed, travelled by train from Omaha to Chicago and thence by air to New York.

Personal Pars

Mr. William E. Huffman, formerly a Second Lieutenant of Air Service, on duty with the 17th Balloon Company, stationed in the Philippines, has returned to the United States and is now employed as foreman of the Aeronautical Construction Department at Fort Omaha.

AMERICAN BAR ASSOCIATION AVIATION COMMITTEE MAKES REPORT

THE Committee on the Law of Aviation of the American Bar Association has made its report and looks forward to securing much valuable information during the ensuing year. This Committee organized upon the appointment of its members by the president of the association. Its membership is as follows: Charles A. Boston, New York, *chairman*, Orrin N. Carter, Chicago, Ill., William P. Bynum, Greensboro, N. C., George G. Bogert, Ithaca, N. Y., and William P. McCracken, Chicago, Ill.

Before the selection of members of the Committee, but with knowledge that the Committee had been authorized, the governors of the Aero Club of America designated a Committee to cooperate. The members of this Committee are as follows: William W. Miller, Stephen H. Philbin, Philip A. Carroll, W. Benton Crisp and Col. Arthur O'Brien.

The Committee has been in correspondence with many of the organizations interested in aviation and has received much assistance from various government departments which have had the law of aviation under consideration.

Consideration has been given to the letter of William V. Rooker, of Indianapolis, on the Jurisprudence of the Atmosphere, which was circulated among the members of the Conference of Delegates at St. Louis last summer, and which contains information and endeavors to classify powers, (1), as between the United States and foreign governments; (2), as between the United States and the several states; (3), as between the political and judicial departments of the United States; (4), as between the state and the owner of land; (5), finally, the nature of such jurisprudence.

The Conference of Commissions on Uniform State Laws at its meeting in August, 1920, adopted the following resolution:

"The whole world has come to a realization of the fact that aviation is practical and not a mere art or fad for pleasure and profit in exhibition flying, for many states in the Union now have scores of aviators constantly flying from state to state carrying commerce between the states, which aviation needs regulation, so your Committee recommends the appointment of a special committee to investigate this subject and report as soon as practical a uniform aviation law."

The members of the Committee of the Commissioners are: John Hinkley, Baltimore, Md., Charles V. Imley, Washington, D. C., Thomas J. Brooks, Bedford, Ind., N. E. Corthell, Laramie, Wyo., George G. Bogert, Ithaca, N. Y., A. T. Stovall, Oklona, Miss., and George B. Young, Montpelier, Vt.

Mr. Hinkley has indicated that he considers the scope of the two committees is different, in that the Bar Association Committee as he assumes is authorized to consider particularly the interstate and international features of the question, while his committee is limited to matters of strictly state regulation.

A communication was received from the Judge Advocate General giving full information respecting action on the regulation of air navigation in the United States, from which it appears that legislation has been passed already in Hawaii, California, Massachusetts, Michigan, Texas, Washington and Wisconsin, while New York now permits aircraft insurance. The Judge Advocate furnished an informative list of articles on the subject, not appearing in the other lists furnished from other sources. It appears that his office has not yet rendered any opinion on the subject, but that some study has been devoted to it and some observations have been made.

Among the suggestions made to the Committee is that from the experience in aviation insurance in many countries there arises a conviction that it is of vital importance to cover as big a territory as possible by the same regulations, and this imperatively calls for Federal laws and Federal supervision, and any legislation by single states, as effective and well-devised as it may be, will ultimately be detrimental to a branch of transportation which by its very nature is successfully possible only if employed over great distances; that such legislation may concern the ship, its cargo, its passengers, ports of flying, the routes and the transportation company itself, and one of the most important points is the person of the pilot.

Information that the Lloyds have an Aviation Committee, and that a bill has been brought before the British Parliament by the British Civil Control Department for Air, intended to give that Department fuller powers by extending very considerably the British Air Navigation Acts of 1911 to 1919.

The foreign manager of the International Fire and Marine Agency Corp. in New York has kindly volunteered to confer with his company's London office and secure copies of the British air navigation acts, and the new bill now pending in Parliament. It is suggested that this legislation is doubtless the most up to date and complete now in existence, and that its study will probably convey considerable indication of points worthy the attention and supervision of a government.

The resume of observations accompanying the letter of the Advocate General deals with the constitutionality of Federal legislation and legislation regulating air navigation, chiefly with analogies of decided cases and legislation in somewhat kindred fields; it deals with air navigation as commerce, with the analogy of the migratory bird acts; with the analogy to railroad traffic; with the analogy to radiotelegraphy; with the desirability for uniform legislation; with the absolute necessity for uniformity in the protection of interstate and foreign air navigation, and the probable effects of such legislation over intrastate air navigation with the analogy of the regulation of private pleasure water craft; with the analogy between navigable air and navigable water; with the possibility of conflict between state and federal claims, in that the Constitution does not grant the same authority over navigable air as over navigable water; with the embarrassment caused by the common law doctrine of *cujus est solum, ejus est usque ad coelum*, and with the denial of the existence of this doctrine, or its limitation by altitude; with the subjection of aircraft to National regulation, and by reason of their relation to the safety of other craft over which the National government would undoubtedly have jurisdiction; the incidental effect of the exercise of Congressional power to see that interstate commerce may be conducted upon fair terms and without molestation and hindrance; with the effect of treaties as extending the national power to deal with the subject covered by the treaty; with the effect of action by Congress over matters clearly within its jurisdiction, but incidentally also within the jurisdiction of the state police power, or other power; with the difference between the exercise by Congress of power in anticipation of a treaty, and of power in fulfillment of a treaty.

The chairman of the Committee, Charles A. Boston, 24 Broad Street, New York, requests any information on the subject of the law of aviation be sent to him.

THE 300 H. P. BENZ AIRCRAFT ENGINE

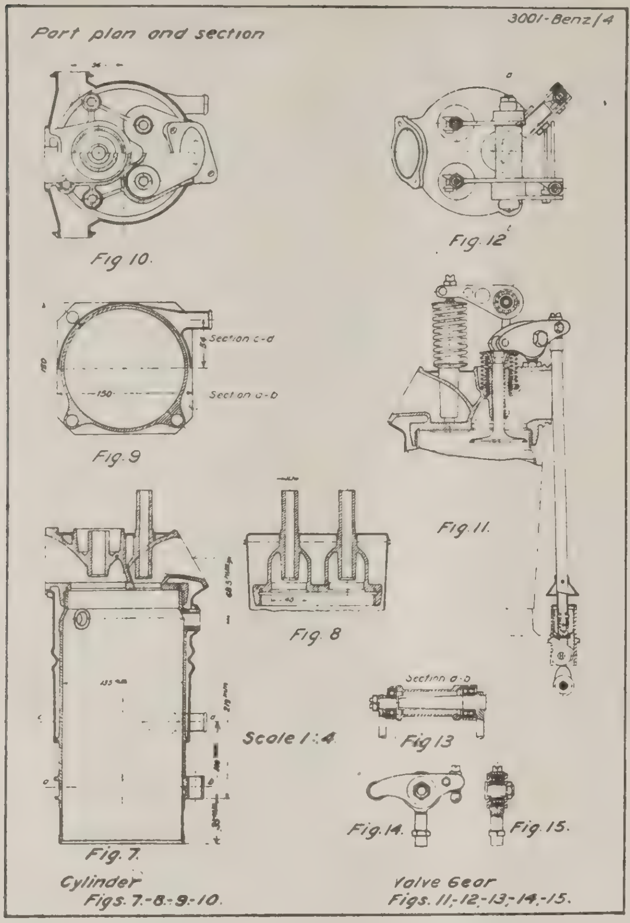
By DR. A. HELLER

(Translated from "Zeitschrift des Vereines Deutscher Ingenieure," by Paris Office, N. A. C. A.)

(Concluded from last week)

In lubricating the engine, the process of continually adding small quantities of fresh oil to the ever-circulating oil has been replaced by simple rotary lubrication; the piston pumps formerly used are now replaced by gear-wheel pumps, which are far more easily driven and are of simpler construction. The former prejudice against simple rotary lubrication, based on the more rapid wearing of the crankshaft bearings through coal and metal dust impurities in the oil, has been proved to be unjustified in experiments made with power-impelled vehicles, while in the case of aircraft engines, in particular, the frequent renewal of the entire oil supply must be taken into account. As applied to gear-wheel pumps, its reliability was at first considered doubtful, as the gear-wheels must be caulked at the sides in the case, and the caulking cannot be replaced later. Experience has shown, however, that the gear-wheel pump supplies sufficiently high oil pressure even after long usage, and that it never loses its tightness to such an extent as to allow the oil to flow back into the crankcase out of the oil reservoir through the pump-case when the engine remains stationary for any length of time, and by so doing to involve difficulties at starting. A safety device, specially constructed to remedy that defect, consisting of a piston kept open by the oil pressure and weighed down by a spring, can therefore be dispensed with.

The triple gear-wheel pump located at the lowest part of the crankcase consists of three separate pumps (Fig. 25), one



of which (1) drives the oil through a nozzle collector into the distribution piping, which is installed on the outside of the crankcase and is therefore easily accessible for cleaning purposes (Fig. 1). This method of installing the distribution piping is now preferred to that of locating it in the crankcase and connecting it with the bearings by transverse boring, experience having proved that cast aluminum has a strong tendency to become porous when the distribution pipe leads into it, and that the boring in question soon loses its tightness.

From the principal bearings the oil flows under pressure through tubes bored in the crankshaft to the crankpin end, then through the tubular interior of the connecting-rod to the piston-pin, which is hollow and thus distributes the excess of oil on the inner surface of the cylinder swept by the piston. The regularity of the lubrication functions is checked by a manometer at the distribution piping, the pressure of which should never be lower than 0.5 atm.

Two more oil pumps (II and III) draw off the oil used in the engine, to the front and rear ends of the crankcase, and force it back into the oil-tank. This prevents the oil from collecting at one end of the engine during the climb or in the course of a nose dive, and also from oiling the cylinder excessively.

A method proposed by Benz & Co. for the construction of the oil-tank is shown in Figs. 26 and 27. Its corrugated outer wall forms a part of the fuselage covering and is therefore effectively cooled by the wind caused by flight. The oil first enters at *a* by means of a partition wall and reaches the jacket *b* of the tank, where it is strongly cooled. If the jacket is full, or coated with congealed oil through intense cold, the oil passes through the projecting rim *c* into the interior of the tank, from which it can flow, in turn, through the aperature *d* into the piping leading to the oil pump. The tank must be provided with a ventilating orifice of about 5 cm. in width, so located that the oil cannot run out either in climbing or in steep gliding flight.

A horizontal sheet-iron collective piping is attached to each of the oil vapor exhaust pipes (Fig. 1) in order to carry off the oil vapor from the crankcase. From them the vapor is carried downward and into the open air by means of pipes fitted with oil receptacles, cut off obliquely at the open ends in such a manner that the sucking effect of the wind created by flight can be utilized at will.

The fuel installation (Fig. 28), which has been constructed on lines conceived after many years of practical experience, consists of a principal reservoir *a* with an auxiliary reservoir *b* built beside it, a fuel-pump *c* worked by the engine, a hand-pump *d* with a fuel scavenger *e* and super-compression valve *f* in the pressure pipe of the pump; from valve *f* the feed-pipe, equipped with a manometer *g*, is conducted into the carburetor. The principal reservoir is filled with fuel from the auxiliary tank, and is likewise under pressure of the outside air, so that in case of damage by gunfire or similar cause, it cannot discharge its contents too quickly. If the contents of the principal tank have run out, however, a safe landing may be effected by means of the contents of the auxiliary tank, as the fuel-pumps can be fed by either tank. The amount supplied by the fuel-pumps is considerably greater than that required by the engine. The surplus passes through super-compression valve *f* into a receiver, from which it either flows back into the auxiliary tank or into the principal tank, according to the manner of its adjustment. This disposal of the fuel leaves each fuel-pump free to act independently of the other, the functioning of the whole being thus assured even when the engine pump may be out of order. The fuel is therefore always supplied to the carburetor under constant super-compression, in which respect it has the advantage over the ordinary device with auxiliary tank, in which the fuel pressure at the carburetor varies considerably in accordance with the angle of the aeroplane and the inbuilding of the auxiliary tank.

The fuel-pump (Fig. 29) consists of an ordinary piston-pump with an aluminum case *a*, bronze bearings *b* and slightly adjusted piston *c*, to which the fuel flows over a combined sieve-scavenger and water separator *d*, the bottom of which can be unscrewed, and an intake ventilator *e* borne down by its own weight. The pump is slowly driven by the control-wheels of the engine by means of a transmission screw. In its original form, as used on the 220-horsepower aircraft engine, it was worked with glycerine as auxiliary fluid. Duration tests soon prove, however, that there is perfect safety in working even when the piston inducts the fuel directly though the interior of the piston must, in such cases, be filled from time to time with viscous oil.

Every time it descends the piston pump drives the sucked-in quantity of fuel-mixture over the ventilator *f*, which is similarly loaded by its own weight, into the so-called super-compression ventilator (see Fig. 30), which simultaneously compensates the pulsations of the fuel-pump somewhat as an air-tank. The cap-like body of the ventilator is inverted over the free end of the exhaust pipe; the caulked rim of the ventilator being held down by a spring, the tension of which can

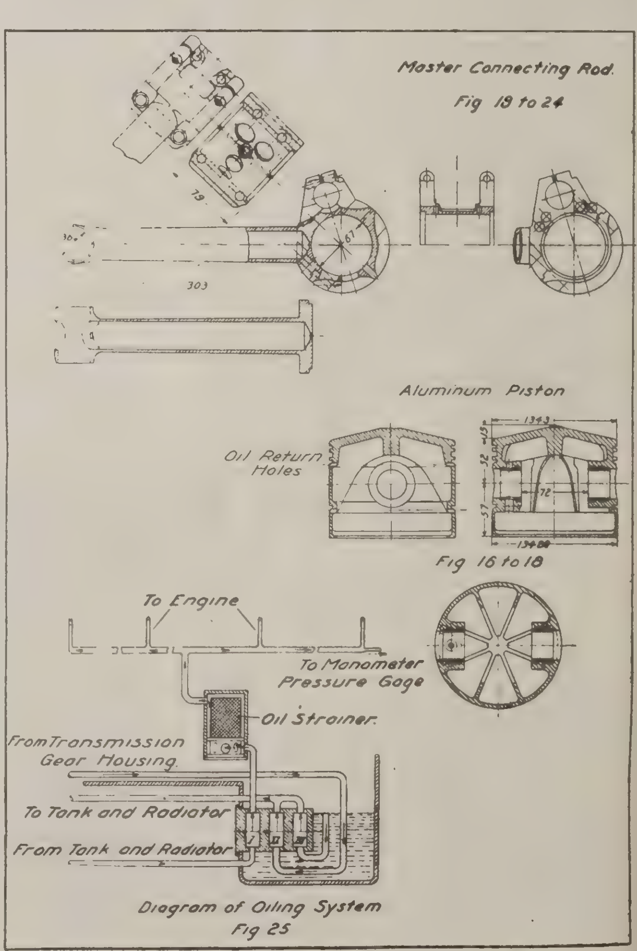
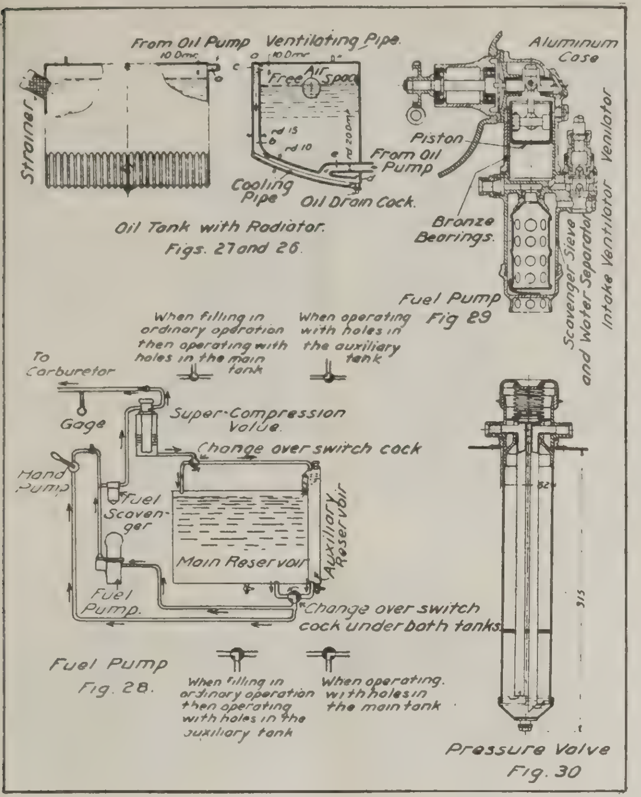


Diagram of Oiling System
Fig 25


From Oil Pump
Ventilating Pipe.
10 Dmr.
10 Dmr
Strainer
Free Air Space
rd 15
rd 10
rd 200mr
From Oil Pump
Cooling Pipe
Oil Drain Cock.
Aluminum Case
Piston
Bronze Bearings.
Scavenger Sieve and Water Separator
Intake Ventilator
Venilator
When filling in ordinary operation then operating with holes in the main tank
When operating with holes in the auxiliary tank
To Carburetor
Gage
Super-Compression Valve.
Change over switch cock
Hand Pump
Fuel Scavenger
Main Reservoir
Auxiliary Reservoir
Fuel Pump.
Change over switch cock under both tanks
When filling in ordinary operation then operating with holes in the auxiliary tank
When operating. with holes in the main tank
315

Oil Tank with Radiator. Figs. 27 and 26.

Fuel Pump Fig 29

Fuel Pump Fig. 28.

Pressure Valve Fig. 30

be so regulated by means of the screw lid that the compression of the fuel at the carburetor amounts to about 0.2 to 0.25. Any surplus supplied by the fuel-pump over the amount required to maintain that pressure and supply the consumption in the carburetor flows down obliquely into the tank (see Fig. 28) surrounding the super-compression valve, which is conducted to the open air. Any marked variation in the fuel pressure is a sign that the air contained in the air-tank has escaped. When working empty it is necessary only to open an air-tap in the intake piping for a time to enable the air-tank to be refilled with air.

The carburetors (see Figs. 31 to 35) are welded together in pairs and covered with a water-jacket; they adjoin the super-compression valve in the same direction as the fuel piping. In the float chamber *a*, the fuel is taken at *b* and scavenged through a fine sieve *c* and kept at a constant height in the usual manner. At this height it also becomes stationary in the principal nozzle *d* (see Fig. 34) of the carburetor, which is connected with the float tank by the calibrated boring *e* of the bottom screw. In its starting position the throttle valve *f* (see Fig. 33) releases only one auxiliary bore *g* of the case; a finely bored auxiliary nozzle *h*, directly supplied with fuel from the carburetor, penetrates into the bore *g* and the strong aspiration thus engendered at the upper edge of the auxiliary nozzle (which may easily be adjusted by changing the position of the air valve) enables the fuel to be well inducted and pulverized even when the engine is working slowly. As the pressure on the upper edge of the principal nozzle *d* augments, through the widening of the throttle opening and increasing engine speed, the fuel becomes so much the more highly aspirated and pulverized in proportion and auxiliary air enters through the aperture *i* between the pipes *k* and *l* (Fig. 34), penetrates to the principal nozzle through fine borings *m* and thereby promotes the pulverization of the fuel and prevents the mixture from becoming too rich in fuel.

The method of carburetor construction above described is based on the French Claudel Carburetor Model and has many recommendations. It is easy of access, and the nozzle can be easily adjusted and taken out from above; its main air stream is perpendicular to the main nozzle, so that the fuel stream branches off at right angles and pulverizes well. The fuel supply which collects at the bottom of the principal nozzle when the engine works slowly also makes it possible for the throttle to open to its full extent suddenly after a gliding flight until it is quite near the ground without there being any risk of the engine's "jib-ing" before the fuel has time to flow in through the bottom opening of the principal nozzle. Another advantage lies in the fact of there being no need for the usual auxiliary air apertures, controlled by the throttle valve and limited by curves, as such apertures can never be quite accurately adjusted, and each separate carburetor must therefore be adapted to the engine for which it is intended.

The double spark-plugs attached to each cylinder for reasons of safety are independently charged by two dynamos (Robert Bosch Co., Ltd., Stuttgart) with 12 plates of 12 poles. The dynamos are driven obliquely from the rear end of the engine by means of ordinary spring coupling (see Fig. 3). They are symmetrically ranged, and constructed for anti-clockwise rotation and a very simple method is obtained for adjusting the sparking point by means of the rods.

The cooling water-pump is installed at the end of the gear-wheel intended for the auxiliary command at the back of the engine, that is, at a spot where the entire contents of the water-jacket and pipes can be discharged. The shaft of the pump is set in ball bearings at the upper end supported by a special block, while the lower end, terminating in a bronze bearing, supports a fixed wheel secured by a pin. The pump has an opening in the middle pipe, and two outlet pipes; it conveys the cooling water on each side of the engine into a main pipe, and this again conveys the principal stream directly through the adjacent cylinder heads, so that the valve heads are most effectively cooled. A weaker auxiliary stream of cooling water penetrates the cylinder jacket from below through a distribution piping, and a flow of water is thus obtained in the direction of the cylinder heads.

An important part of the engine is the reducing gear, its function being that of keeping the number of revolutions of the propeller within such limits that the propeller efficiency may be good notwithstanding the much-desired increase in the number of revolutions of the engine. The type in question is the outcome of years of experiment, unsuccessful until now for the very reason that with gear-wheels, strong wearing of the wheels could not be prevented in the course of long working, even with larger wheel dimensions. As regards reliability, this type may be classed with the only really durable foreign engine gear—that is, the Rolls Royce Co.'s gear—though it has the advantage over the latter on account of its great simplicity. The gear has been specially designed to attain the greatest possible transmission ratio for each revolution of the gear-wheels, at the same time without exceeding the regulation limits for all-over dimensions and weight. The number of revolutions of the propeller, estimated at about 900 r.p.m. for geared aircraft engines, is therefore augmented to 1,180 r.p.m., a speed which is also compatible with satisfactory propeller efficiency.

The outer part of the gear is connected with the flange of the crankshaft by inside gear work, and the central wheel is fixed. It is therefore provided with a lever, made to revolve on the gear-box and adjustable to some extent, and the un-

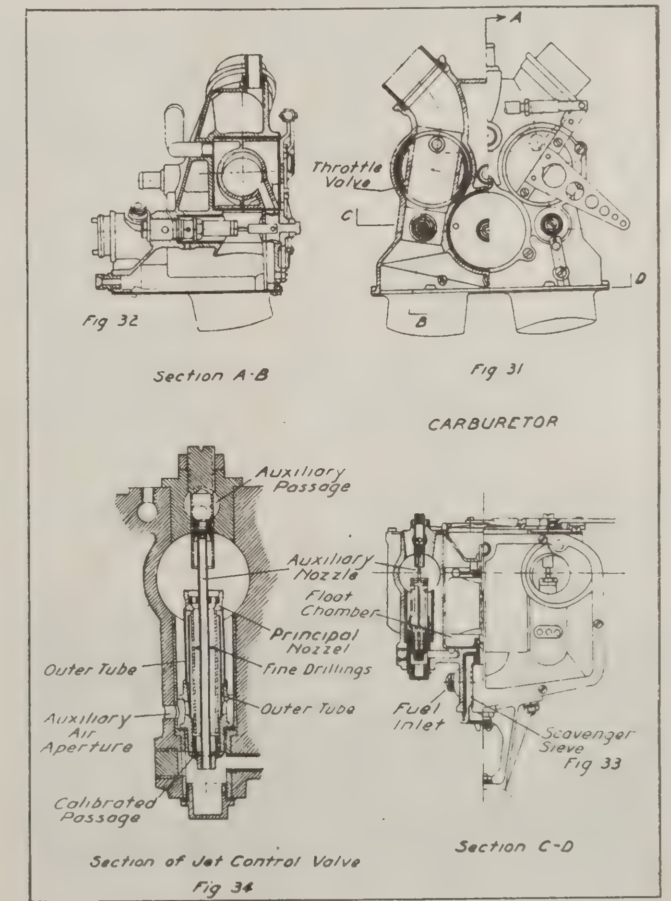


Fig 32

Section A-B

Fig 31

CARBURETOR

Section of Jet Control Valve

Fig 34

Fig 33

Section C-D

avoidable oscillations of the crankshaft are thus compensated. The four star-wheels, all set on one star, revolve between these two rings of wheels and thus drive the propeller, which is attached to the star. The crankshaft is cast in one piece with the star and runs on two strong ball bearings, the inner one located at the end of the crankshaft, the outer one in the gear-case. On this shaft the fixed central wheel of the gear rest on two ball bearings, and it is this artifice alone which enables the propeller to be driven by the star. Special care had been bestowed on the location and setting of the star-wheels, which attain an extremely high number of revolutions. Each of them revolves on two double ball bearings, which are filled with balls and thus work without cages, experience having shown that ball-cages are not capable of withstanding the stress brought to bear upon them during flight. The bearings are lubricated from the interior by oil flowing from the crankshaft cavity. When mounting, the star-wheels can be laid in a regular line along their respective notched discs by turning the cones, which are slightly eccentrically turned; by this means the peripheral forces are evenly distributed over several teeth. The double bearing built into the front end of the crankshaft prevents longitudinal displacement of the crankshaft at the gear. By means of the projecting hexagonal edge the gear can easily be taken down.

In a newer type of the valve, the regulating lever of the fixed gear-wheel (which lever hangs downward) and one of the ball-bearings are dispensed with by the direct transfer of the rotational moment of the fixed wheel to the front flange and to the gear-box through a rotary coupling.

The propeller is attached to an auxliary flange by the usual hub and short bolt, and the flange is secured to the ball-end of the rear shaft by a key.

THE OPTICAL WING ALIGNING DEVICE OF THE LANGLEY FIELD TUNNEL

By F. H. NORTON and D. L. BACON

Aerodynamical Laboratory, N. A. C. A., Langley Field, Va.

IN conducting tests on aerofoil models at the Langley Memorial Aeronautical Laboratory, the technical staff of the National Advisory Committee for Aeronautics have devised the following convenient and accurate method of aligning the wing chord with the air flow.

This device has been developed to permit rapid and accurate alignment of aerofoils and models with the air stream passing through the tunnel. It consists of three main parts: a projector, a reflector and a target, and these parts are arranged as shown in Figure 1. The projector is mounted at the same height as the axis of the tunnel and projects a beam through a vertical slit and lens against a narrow mirror clamped to the chord of the aerofoil, from which the beam is reflected back to a target, consisting of a white ground on which is ruled a vertical line, mounted directly below the projector. If the chord of a wing is correctly aligned with the air stream the projected band of light will be superimposed upon the black line of the target.

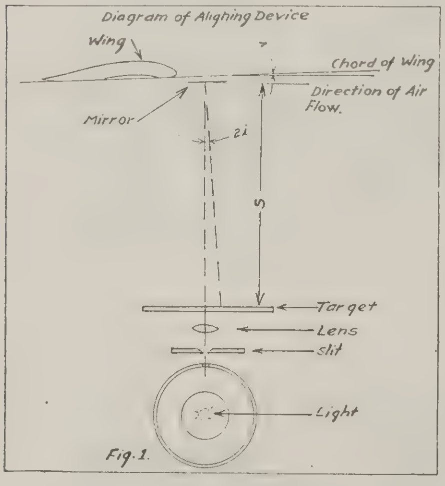


Fig. 1.

A movement of the mirror of one degree, deflects the reflected beam two degrees with a resulting displacement on the target of S tan 2i, S being the distance between mirror and target and i the angle of movement of the wing. The deflection may easily be read to as low as 1/50 of an inch and as 1° movement of the wing gives about 2 inch deflection on the target, it is obvious that the corresponding error in chord alignment need not be greater than 1/100 of a degree.

The actual construction of the individual parts is shown in Figures 2 and 3. The illuminator, a concentrated filament nitrogen filled bulb, is mounted in common with the slit, lens and target on a single cast iron base which slides on horizontal iron ways bolted to the wall of the experimental chamber. This permits the entire device to be moved fore and aft to accommodate various locations of the mirror inside the tunnel. Obviously the accuracy of the instrument does not depend on the alignment of these ways, for, as long as they are straight, the projected beam will remain parallel to its initial position or perpendicular to the air stream. Adjustment of the zero position is made by changing the lateral position of the slit until the lift drag values obtained from the same aerofoil mounted in erect and inverted position on the balance show the same magnitudes at equal indicated angles of incidence. The mirror may be tilted in its clamp about a horizontal axis, allowing it to be used in various positions along the span of the aerofoil if so desired, and still reflect the beam against the target. This axis is set horizontal when the mirror is clamped to the wing, by the aid of a small spirit level built integral with the clamping device.

This arrangement has proven satisfactory in operation and is far more expeditious than the old method of sighting across a long batten, as the operator of the balance may see the target and directly judge of the accuracy of his alignment. Whereas the old method required two operators and several minutes' time to align to within 1/10 degree, this method enables one operator to align a wing to within 1/100 of a degree in a few seconds. This method also has the advantage of being able to measure the angle of the wing while the tunnel is running, thus showing the true angle of incidence.

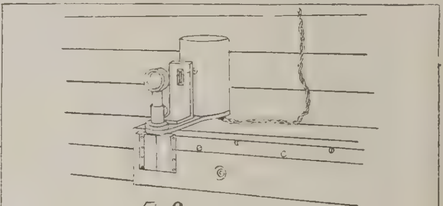


Fig. 2.

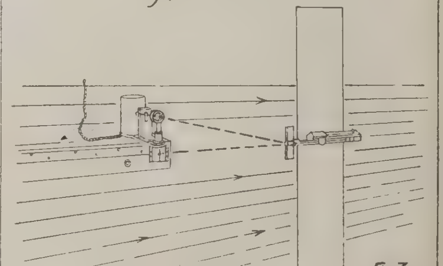


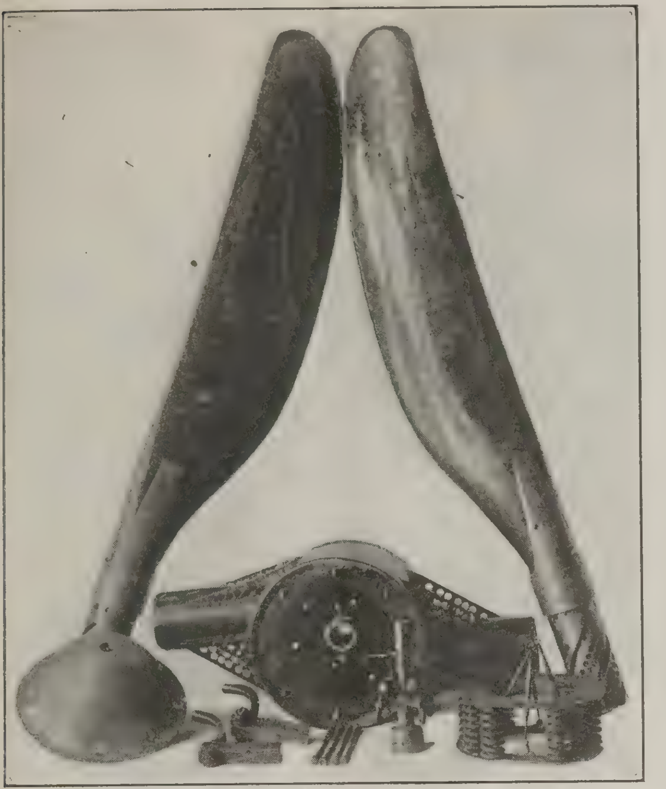
Fig. 3.

PARKER VARIABLE PITCH AIR SCREW

By BILLY PARKER

IT has been admitted for some time that there is a vast need for a variable pitch airscrew, since it is a well known fact that the ordinary screw, if properly designed for climb, does not possess a high enough pitch after the machine has attained maximum flying speed. It has also been demonstrated that when a machine is traveling at a high altitude in rarefied air, the ordinary screw will slip considerably more than in heavier air, although the aeroplane proper would travel much faster through this thin air if the same tractive force could be exerted here as at lower levels, owing to the fact that the light or thin air offers so little resistance to the progress of the aeroplane.

However, in view of the fact that these things have been known for some time, there have been but few serious attempts at a variable pitch airscrew, and most of them have been of such a nature as to render them practically impossible



Details of the Parker Variable Pitch Propeller

for aviation purposes, owing to excessive weight and low factors of safety. Nearly every one of them have been manually controlled, and since the pressure exerted by the air on the blades is so very great at maximum motor speeds, it would be practically impossible for a pilot to operate the levers controlling the pitch of the blades. In addition, all this complication of levers leads to excessive weight, and since the pilot of the present day aeroplane has enough to occupy his attention at all times it is hardly probable to expect him to move and operate levers requiring a number of hundred pounds of pressure to change their positions. This would be more of a problem than ever in multi-motored machines.

The writer has spent the past six years in developing a variable pitch screw that is entirely automatic in operation. As the motor speeds up after leaving the ground, the pitch of the blades increases, and likewise as the machine climbs into higher altitudes and more rarefied air is encountered, the blades automatically increase their pitch—so that the same load is kept on the motor at all speeds and conditions of flight, except in climbing, at which time the pilot can, by simply pushing a button, make the blades assume their best climbing angle. This propeller has been found to be very accurate in operation, and the blades increase or decrease their pitch with the very slightest variation of motor speed. It has also been found that in case the motor misses fire, or for any other reason looses power and slows down—the blades immediately decrease in pitch, and do not overload the motor, but really assume the pitch dimensions of a screw for the horsepower that the motor is actually delivering at the time.

The airscrew shown in the accompanying illustrations has been very successfully flown for the past two years, although the later models are lighter and are contained in a much smaller and more streamline hub. The performance of this screw is truly surprising, even on machines of low horsepower and high head resistance; of course this screw would be considerably more efficient on planes of higher horsepower and lower head resistance, although the writer has never had the opportunity to test it on high powered machines. I firmly believe, however, that on a plane similar to the LePere, and equipped with some sort of supercharger, this variable pitch airscrew will make the speed of from three to four hundred miles per hour possible, at an elevation of thirty to forty thousand feet.

An accurate table of specifications and performance of the screw shown in the cuts is given below:—

Aeroplane (Biplane)

Type	Dewey AI scout.
Motor	Curtiss OX5
Spread	32′6″
Chord	4′6″
Propeller	Curtiss D 5000 8′ diam. 5′3″ pitch
High speed	86 M.P.H.
Climb first min	410′
Ceiling	14,000′
Same plane equipped with variable pitch propeller:	
Climb first min	720′
High speed	118 M.P.H.
Ceiling	16,500′

The above figures are absolutely accurate, as the tests with and without the variable screw were made on the same day and under the same conditions. The speed tests were made at an altitude of one hundred feet, in a triangular circuit, and the climbing tests were made in straight flight and tested with a recording barograph.

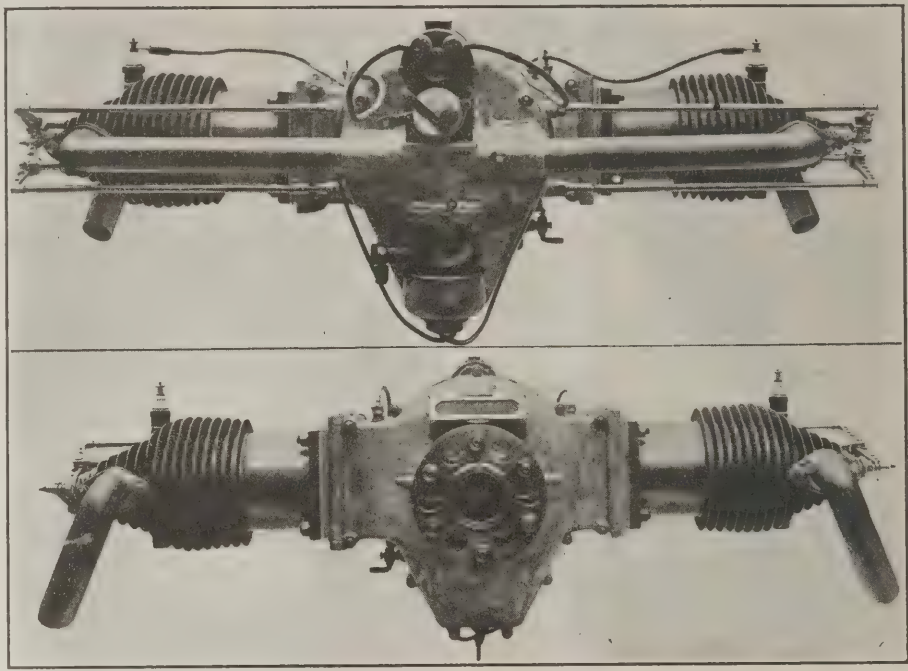
It will be noticed that although the initial climb is much greater with the variable screw, the ceiling is very little better. I attribute that to the fact that the motor was designed for low flying and was in no way fitted to fly at altitudes higher than 15,000′. The low compression of the Curtiss OX5, and the lack of means for supplying air to the motor are without doubt the reasons for this. In fact the only reason that any greater ceiling was reached at all was probably due to the fact that the first few thousand feet were reached in a much shorter time than with the ordinary screw, simply giving more fuel and more time to gain a little more altitude.

When trying for high speed, I have adopted the following plan. First I reach the elevation that I desire to do my flying in, or in truth, I attain a little more elevation than that, then by diving the ship a little way and speeding up the motor, the variable airscrew assumes a greater angular pitch, which can be maintained by the same wire that regulates the altitude or climbing control, after a normal line of flight has been resumed. In this manner one can experiment until the correct pitch for the fastest flight is attained. This method of obtaining higher angular pitch is the only satisfactory one that I have been able to find, and after a few trials the pilot can make the blades assume nearly the correct pitch at once. It has also been found that by making the blades assume a comparatively high pitch after sufficient altitude has been attained, the motor can be throttled very low (as low as 400 R.P.M.) and the ship will still maintain a fairly high speed, and use very little fuel.

The weight of the variable pitch screw described is sixty-two pounds; the minimum length is eight feet and the maximum length is eight feet and two inches. The minimum pitch is three feet six inches, and the maximum pitch is eight feet and nine inches.

Curtiss Biplane Equipped with Parker Variable Pitch Propeller

THE HERMAN HAACKE MOTOR



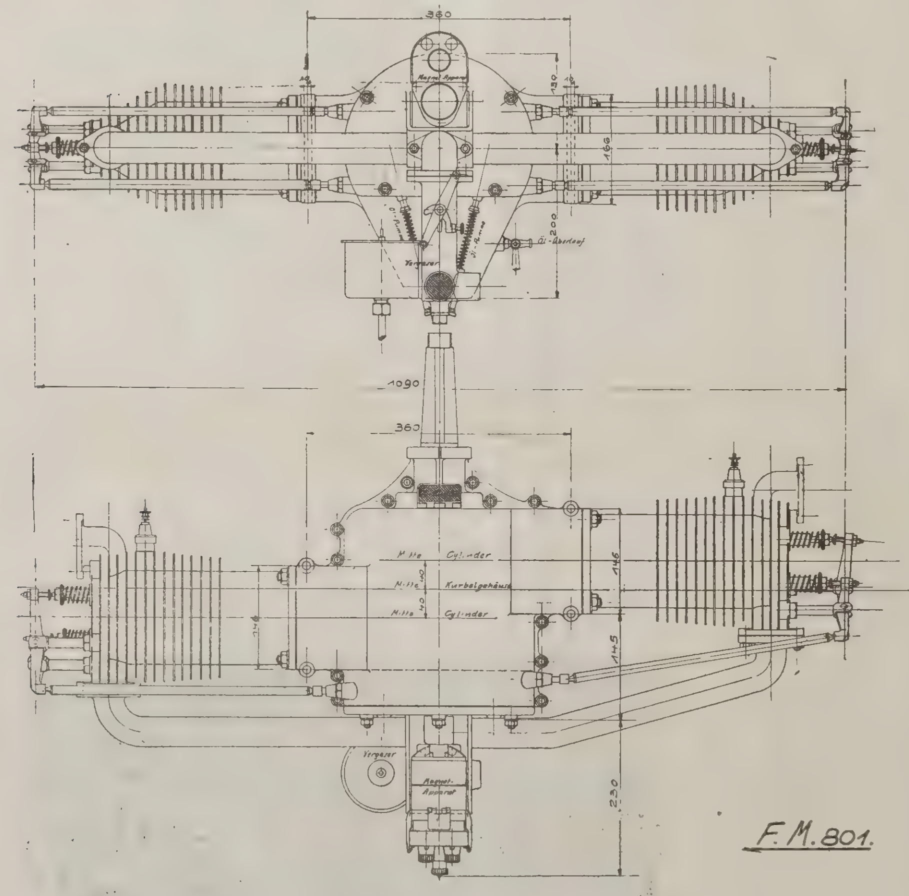
Two views of the Herman Haacke 35 H.P. Motor

AMONG the many new motors which are ready to supply the growing demand for small light powered aviation engines, the product of the factory of Herman Haacke of Berlin-Johannisthal deserves special mention. The Haacke motors have maintained themselves on the market for sometime with three models—a 3-cyl. fan type, 5-cyl. and 10-cyl. star type of 35, 60 and 120 H.P. respectively. All types are air-cooled and the designer has apparently concentrated his attention on simplicity of construction and accessibility rather than lightness.

The cylinders are semi-steel castings with 15 integral cooling flanges, valves being located in the head and operated by a conventional push-rod and rocker-arm mechanism, excepting the 60 H.P. model, of which the cylinders differ in having "L" shaped cylinders with direct-operated exhaust valves and automatic intakes. Cast iron pistons are used and the timing gear housing is integrally cast with the aluminum crankcase.

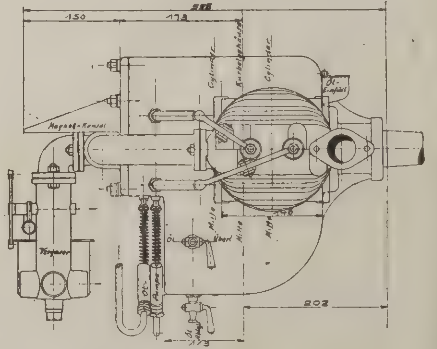
In addition to the above, this firm has started production on a 2-cyl. opposed type made in two sizes—of 112 mm. (4.41") and 120 mm. (4.72") bore, with 140 mm. (5.51") stroke, delivering respectively 28 and 30 H.P. at 1300 R.P.M. These types should prove very popular in the construction of small machines in spite of their weight of 60 kgs. (132 lbs.).

The cylinders are stagged 3⅛", allowing an unusually strong crankshaft construction. The cast aluminum crankcase is shaped so as to accommodate a sump from which the oil is drawn by two immersed plunger pumps operated by the two intake cams, each pump working independently and squirting the oil upon the crankshaft, which distributes it from centrifugal action. The sump is separated from the crankcase itself by a false bottom provided with two constant level openings and will hold 2½ litres (.66 gal.) of oil sufficient for six to eight hours' running. The cover of the crankcase is integrally cast with the magneto and tachometer mounting, as well as the middle part of the intake manifold, which is thus automatically kept at the proper temperature.



Rear and plan diagrams of the Herman Haacke Motor

The motor is attached to its mounting by means of four bolts passing through special lugs cast into the crankcase housing.



Side diagram of the Herman Haacke Motor

The larger of these motors drives the propeller 2.15 metres (7.054 ft.) dia. by 1.10 metres (3.609 ft.) pitch. The smaller 2 metres (6.562 ft.) dia. by 1.20 metres (3.937 ft.) pitch.

Ignition is effected by magneto, the spark plugs being located in the upper part of the combustion chamber.

BELLANCA ANNOUNCES FIVE-SEATER

THE determined purpose of aircraft experimenters has been and is yet that of improving the stability and safety of the aeroplane, and at the same time increasing the useful load and speed for the unit of power used.

In the early stages of aviation a machine carrying only four or five pounds for every pound of thrust was regarded as efficient, and during 1913-14 machines were developed to carry an average weight of 5.5 pounds. During the War this was jumped to 7.5 pounds.

Considerable progress has been made since the War in carrying capacity, and the latest type of commercial Bellanca C. E. two-seater was capable of carrying 11.5 pounds for each pound of thrust. The designers of the "Alula" wing have claimed a lift of 15 pounds for each pound of thrust.

The new Bellanca C. F. five-seater will represent another marked advancement in the line of power economy, bettering the high results obtained by the Bellanca C. E., and carrying 12 pounds of load for every pound of thrust. The result of this is that with a motor of only 95 H.P. it will be able to carry a load of five persons (4 passengers and pilot) and fuel sufficient for a flight of 585 miles. Mr. Bellanca has arrived at these results by eliminating to a great extent parasite resistance. The wires will be completely eliminated and practically all of the resistance will be given by the body and the landing gear which as been designed with the maximum of simplicity.

The machine seats with comfort four passengers in a luxuriously upholstered cabin. The pilot is seated in such a position that while he can see freely up and down yet he is well protected from the rush of air, thereby contributing to the general economy and comfort of the machine.

The controls have been well studied to give easy and complete control at high and landing speed.

The 95 H.P. Anzani, of well-known simplicity, is mounted in a convenient manner to give the maximum of accessibility, and the loads of the machine are so distributed as to maintain the center of gravity of the machine always in the same location. This makes it possible to fly the machine with complete balance either with the pilot alone or with a full load.

In designing the machine Mr. Bellanca has had prominently in his mind the reduction of manufacturing costs, and it is contemplated that this new type will constitute one of the most economic machines built from the standpoint of purchase price and cost of handling. The machine is planned in such a way that it is a real production job even at a comparatively small rate of production.

General Specifications

Span	40′
Overall length	22.8′
Overall height	7.6′
Total area of wings	280 sq. ft.
Engine (Anzani)	95 H.P.
Weight of machine empty	870 lbs.
Useful load	1080 lbs.
Weight of machine loaded	1950 lbs.
Weight per square foot	6.95 lbs.
Safety factor of wings	9

Performances (With Full Useful Load)

Maximum speed miles per hour	108
Minimum speed miles per hour	42
Minimum H.P. required for horizontal flight	30
Maximum economic mileage	585 miles
Time in the air	6.6 hours
Climb first minute	630 feet
Climb in 4 minutes	2,500 feet
Climb in 8 minutes	5,000 feet
Climb in 13 minutes	7,500 feet
Climb in 22 minutes	10,000 feet
Climb in 38 minutes	12,500 feet

Performances (With Light Load)

Maximum speed miles per hour	110
Minimum speed miles per hour	33
Minimum H.P. required for horizontal flight	12
Climb first minute	1,420 feet
Climb in 5 minutes	6,000 feet
Climb in 11.5 minutes	12,000 feet
Climb in 21.5 minutes	18,000 feet

Mr. Bellanca's association with the pioneer days and later day development of aircraft design is interesting in that, in 1910 he acquired distinction as a Professor of Mathematics of the Milan University, Italy. His knowledge of deductive science and a deep interest in the solution of heavier-than-air craft problems assisted his rapid advancement in that direction on taking up aeroplane designing as a profession.

That year, 1907, and in 1909, he had produced two types of biplanes that were conceded to be of advanced design and utility. In 1910 he introduced the "Bellanca" Tractor Biplane. Realizing that the time was not ripe for capitalizing his skill and knowledge in Italy he came to the United States as offering a wider and surer field for his ambitions. Mr. Bellanca was actively identified in 1911 with the Long Island activities in aerial endeavor and established a school of flying. Among his pupils was the present Chairman of the Board of Aldermen of New York City, Major La Guardia, who acquired distinction in the American Flying Forces in Italy during the late war.

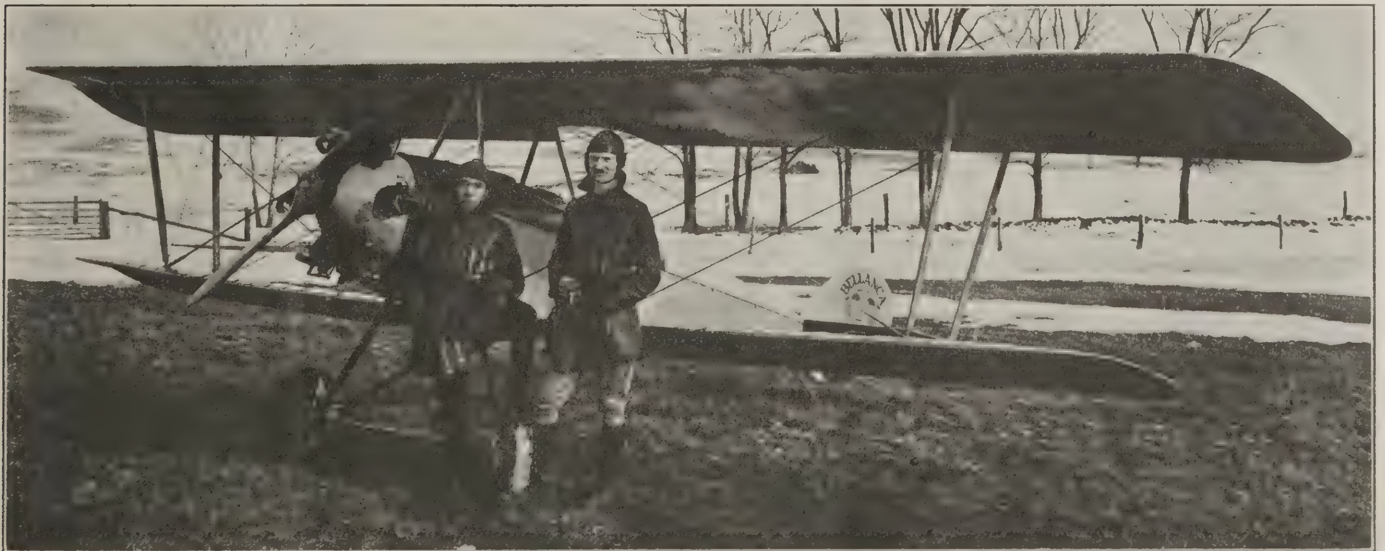
Turning his attention to the monoplane type he designed three highly successful and efficient machines during 1911, 1912 and 1916.

In 1917 he undertook the development of his "Bellanca C.E." two-seater biplane, in association with a Maryland pressed steel concern, and established such a remarkable record that it attracted the attention of military and naval authorities in its adaptability for active service.

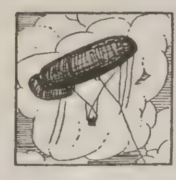
The performance and efficiency of the machine acquired by Mr. C. D. Chamberlin, of Iowa, accentuated the interest in a practical manner but the concern that had undertaken development and manufacture—by reasons associated with their other business—could not proceed.

While awaiting disposition of the demonstrating plane and a number of unfinished machines, now at Baltimore, Md., Professor Bellanca has completed the designing of his "Bellanca C.F." five-seater commercial plane the specifications and estimated performances of which places it in a distinct class of its own and may be estimated to meet the need of the day in the American aeroplane market.

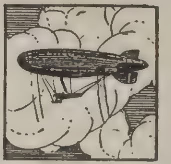
As a comprehensive manufacturing opportunity the disposition of the demonstrating unfinished planes and a large quantity of material available for assuring immediate production of a popular two-seater type, cannot be overestimated and should be considered in view of the present status of aeronautics in this country.



The Bellanca C.E. 2-Seater Biplane. On the left is Professor Bellanca, designer of the machine



FOREIGN TECHNICAL DIGEST



German Night-Landing Scheme

A short description is given in this article of a wind direction indicator for night landing. Eight lights are arranged on the aerodrome in the formation of a large circle; each light being situated at points corresponding on the compass to N., N.E., E., S.E., S., S.W., W., and N.W. Another light is situated in the center of this imaginary circle. All of the lights are fixed in boxes with glazed tops, and are sunk in the ground—flush with the surface. Only five of these lights become luminous at one time; three being on the circumference, one the center light of the circle, and the last, that one diametrically in line with the center one of the first three mentioned. This forms the outline of an arrow and indicates the direction in which a machine should land in order to face the prevailing wind. The installation controlling the lights is operated by a wind vane automatically, and therefore requires no attention in indicating the direction of the wind. (*"Illustrierte Flugwelt"* 24th Nov. 1920.)

New Drift Corrector

This article describes in detail an ingenious instrument, devised by M. Le Prieur, for determining the drift of an areoplane in flight, thereby enabling the course to be corrected. It consists of a sighting tube fitted with hair line indices mounted upon one side and a slideable pencil carried by the other side of a parallel link motion. On the base of the instrument there is fixed a ruled card, ruled with lines parallel to the longitudinal axis of the machine. A fixed object having been selected, it is brought to coincidence with the index marks of the sight, and the pencil is slid down to make a dot on the paper. This process is repeated several times, and gives a row of dots showing the apparent path of the object, and a very close estimate of the mean angle of drift is thus obtainable.

To use the results obtained, M. Le Prieur has devised a course corrector which is fully illustrated. (*L'Aeronautique*, November-December, 1920.)

Novel German Testing Plant

A brief description is given of an interesting German attempt to make aerodynamic tests on full-size aircraft.

Upon a special railway truck is erected a tower of steel tube, 10 metres high, upon which the aeroplane under test is mounted. The aeroplane is attached to the tower through hydraulic dynamometers, which give readings on the truck itself, from which the lifts, drags and moments exerted on the aeroplane can be measured.

The test truck is drawn by a locomotive at speeds limited by the conditions of the track to a maximum of about 60 k.p.h. This apparatus has been used for experimental work, with varying success, from 1916-1918, but under the provisions of the Peace Treaty it has been deleted (*Aeroplane*, January 19, 1921, 1 illustration.)

The Pischof "Avionnette"

This article describes M. de Pischof's latest efforts in the construction of a small sporting machine or "aero-scooter." The "Avionnette" is remarkable for its small size and decided unique design. The engine is a two-cylinder horizontally opposed Clerget developing but 16 h.p. The speed range is from 36-60 m.p.h., and it carries sufficient fuel for two-hours' flight. It is a tractor biplane, of metal construction practically throughout. Its most important feature being the ingenious method of assembling and dismantling the main planes and the facility with which either can be accomplished.

The *fuselage* consists of two superimposed steel tubes, connected by vertical tubular members. The tail plane, which is of the lifting type at 0° incidence, carries a load of about 16 lbs. The pilot is located on a species of plough seat mounted on the top *fuselage* tube, forward of the trailing edge of the top plane. The top plane is cut away in the centre to receive the body of the pilot, who, from his high position, has a very good range of vision. The control stick, which is only some 12 ins. in length, is mounted on the top *fuselage* member in front of the pilot, whilst the rudder control, consisting of two pedals, is mounted on the lower centre section.

The principal characteristics are:

Span	17 ft.
Length	11 ft. 6 ins.
Height	4 ft. 3¼ ins.
Wheel track (width folded)	2 ft. 7½ ins.
Area of main planes	80¾ sq. ft.
Area of tail plane	5¼ sq. ft.
Weight of machine empty	225 lbs.
Loading per sq. ft.	2.78 lbs.
Loading per h.p.	14 lbs.
Climb	4,000 ft./52 mins.

(*Flight*, January 20, 1921, 3 illustrations, 1 diagram.)

The Seaplane Engine

The author makes comparison between the 260 B.H.P. Maybach Mb IV A., the 185 B.H.P. Bayern B.M.W. III. a, the 320 B.H.P. Rolls Royce, and the 400 B.H.P. Liberty.

A table showing the stresses in various parts of these engines, on the assumption that the maximum pressure, $p_z = 30$ kgs./cm² is given.

	Mb IV A.	B.M.W. III A	R.R.	Liberty
CRANK PIN—				
Diameter, cm.	6.6	5.8	5.4	6.04
Length, cm.	6.5	6.6	4.1	5.5
Pressure, kg./cm.²	150	139	137	115
Velocity of pin, m./sec.	4.85	4.7	5.1	5.2
Friction work, kgm./cm.² sec.	730	653	700	595
MAIN JOURNAL—				
Diameter, cm.	6.6	5.8	6.3	6.67
Length, cm.	5.5	5.0	3.1	5.1
Pressure, kg./cm.²	88.5	92	78.5	66.2
Velocity of journal, m./sec.	4.85	4.7	5.95	5.75
Friction work, kgm./cm.² sec.	430	432	467	380
GUDGEON PIN—				
Diameter, cm.	3.8	3.2	2.8	3.16
Length, cm.	9.3	7.4	4.4	5.1
Pressure, kg./cm.²	182	226	249	234
M.E.P. (brake), kg./cm.²	6.85	6.22	8.0	7.65

A table gives the following particulars of these engines:—

	Mb IV A.	B.M.W. III A	R.R.	Liberty
Nominal HP.	260	185	320	400
Actual BHP.	280	213	320	381
Weight of engine, kg.	411	301	430	396
Weight of cooling gear, kg.	50	38	71	84
Total weight, kg.	461	339	501	480
Weight per BHP. kg./BHP.	1.645	1.59	1.565	1.26
Fuel consumption, gram./BHP. hour	200	200	225	230
Weight of installation, including fuel for 10 hours, kg.	1021	765	1221	1356
Weight of installation, including fuel for 20 hours, kg.	1581	1191	1941	2232
Weight of installation, including fuel per BHP. for 10 hours, kg.	3.645	3.59	3.82	3.56
Weight of installation, including fuel per BHP. for 20 hours, kg.	5.645	5.59	6.07	5.86

The author considers that the ideal engine for seaplanes should be designed following German practice with cylinders all in line and have a performance of the Maybach and B. M. W. engines. (O. Schwager, *Der Motorwagen*, Nov. 10, 1920, 3 pp., 6 tables.)

L Z 120

The following are the specifications of the LZ120 handed over to Italy under the terms of the Peace Treaty:—

Capacity, 55,000 c. m.
Length, 195 m.
Height, 28.5 m.
Diameter, 24 m.
Useful load, 32 tons.
Speed, 110 km. per hour.
Engines, 6 of the Maybach type.

It will be remembered that the ex-LZ120, now "Ansonia," bombarded London three times and Paris four times, in addition to carrying out many other bombardments over minor cities. (*Aeronautics*, January 20, 1921.)

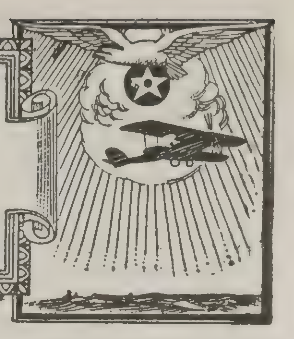
Application of Photography and Hydrography

Attention is called in the *Ingegneria Italiana* to the importance of the paper submitted to the French Academy of Science by M. Volmat, in which he gives particulars of aerial photographic experiments carried out from a hydroplane, and emphasizes the importance of such a method in drawing up sea charts, so as to obtain quickly and exactly particulars relating to the lie of the coast, the conformity of shoals discovered at low-water, etc.

In the tests carried out 17 m. below zero on the chart was the greatest depth at which the bottom could be clearly seen. Great depths produce a characteristic surface movement of the waves. From the impressions on a photographic plate of wave action it has been possible to discover a point of rock 8 m. below zero.

The photographs were taken vertically and generally at an altitude of 2,600 m. The methods adopted could no doubt be improved upon, but they give a lead. (*Ingegneria Italiana*, Nov. 4, 1920, ¾ col.)

NAVAL *and* MILITARY AERONAUTICS



Practice Bombing on Silhouette of the "Massachusetts" at Aberdeen

A silhouette of the battleship *Massachusetts* has been laid out on the bombing field at Aberdeen Proving Ground, and bombing is being carried on from various altitudes. All bombs are being recorded and a complete report will be rendered on the program with the view of bombing the battleship at some future date.

Permanent Air Stations Plan

The Chief of the Army Air Service has under consideration the question of the present design of army air service stations with a view to gathering information for the adoption of a design for permanent stations. While in most cases the buildings erected were constructed under stress of war conditions, the general plan was made after much study and has answered the purpose for which constructed. Now that the general layout at Air Service activities has been under observation for a considerable length of time it is considered that commanding officers are in a position to give the office of the Chief of Air Service a great deal of assistance by making recommendations in connection with future construction. They have been directed to give this matter their particular attention and study. It has also been suggested that consultation with staff officers and others immediately concerned will bring forth a great deal of constructive criticism which will be of value to the commanding officer in making his final recommendations. These recommendations are to include the general layout and the details as to design of building, storage space, shops, installation of equipment, etc. They are to differentiate between permanent and temporary installation, but there is no reason why the recommendations for permanent installations cannot be used as a model for temporary installations. It is not anticipated that the general layout plan, except perhaps for officers' and non-commissioned officers' quarters, will be materially different, the major difference being only in structural design and material used. As the Air Service is now occupying temporary structures erected during the war, it will be only a matter of time before permanent stations will have to be erected. The Chief of Air Service therefore desires to bring together past experiences in order to avoid the adoption of plans which do not embody features essential to the most efficient and economical operation.

Air Service Medical Policy

A board of officers was recently convened by the Chief of Air Service to recommend a definite policy as to the physical standards considered necessary by the Air Service for applicants for flying training in both heavier-than-air and lighter-than-air service.

The action of the board, which was approved by the Chief of Air Service December 31st was as follows:

"The Board recommended unanimously that no waivers of physical defects be recommended in the cases of applicants for flying training, except such minor physical defects as would, in the opinion of the Chief Surgeon of the Air Service, have no bearing on his duties as a pilot or as an observer in either heavier-than-air or lighter-than-air service."

Personal Pars

Lt. Col. T. A. Baldwin, Jr., has assumed command of Ross Field, California.

Major M. F. Harmon, Jr., is assigned to office Chief of Air Service.

Major R. Walsh has been assigned to Canal Zone.

Major John F. Curry, Department Air Service Officer, was quietly married on Thursday afternoon, January 6th, in Honolulu, to Miss Eleanor D. Montgomery, of Oakland, California. The wedding was attended by a small number of close friends of the bride and groom.

John W. Currell, formerly in the Service, has submitted to the Navy Department an elaborate system of lighting and signaling for transcontinental flights.

The Medical Problems of Flying

The question of occupational diseases is one of fairly widespread interest, not alone to medical men but to those who give thought to the welfare and development of humanity.

When the industrial era was unfolding in the nineteenth century little personal thought and no hard thinking was given to the hygiene of industry, and so there are still long arrears of occupational diseases and injury to atone for. Many industries have still to establish their right to exist before the tribunal of public health. Since we hope to do these things better in the twentieth century, every new medium in and through which the business of the future is in any way to be transacted, is made, at the outset of its career, to pass within the scrutiny of medical as well as commercial experts.

In this connection the study of the medical problems that have appeared in the development of aeronautics is of paramount interest, and those who may be engaged in investigation along this line will find valuable information in the pages of the latest report of the Air Investigation Committee appointed by the Medical Research Council in consultation with the Air Ministry of Great Britain.

"It is clearly impossible," according to the report referred to, "to draw an absolutely sharp line of distinction between the immediate and remote effects of flying at low as opposed to high altitudes, because many symptoms are common to both. At the same time, in healthy and fit individuals who fly from 15,000 to 20,000 feet or more, a group of symptoms can be isolated which may, properly, be attributed to the physical effects induced by the lowered pressure of oxygen in the air breathed. It must be borne in mind that the necessity for attention to the technical and other duties of a flight may, in itself, suffice to divert a flyer's notice from physical symptoms unless the latter become imperative. Further, it must be remembered that one of the most important effects of oxygen starvation is a dulling of the judgment and intellect and an unwarranted sense of well-being and security.

In this connection the cases of two flight commanders may be cited who averred they were just as fit at 20,000 feet as on the ground, and scoffed at the idea of using oxygen. A week later, however, these same officers, having both used oxygen for a long flight of more than three hours at an altitude of over 18,000 feet, were loud in their praise of the benefits it conferred, and made its use compulsory among their pilots and observers."

The most interesting aspect of the whole question, and one of great practical importance, is the remarkable variation met with among individuals who are, apparently, equally healthy. The use of Flack's bag experiment enables one to isolate those very rare cases of men with heart and lungs stethoscopically normal who are so peculiarly sensitive to the effects of even a moderate fall of barometric pressure that they are, practically, debarred from flying of any description. But, beyond these quite exceptional cases, marked differences exist as regards the reaction of the organism to diminished oxygen pressure, and many pilots, especially scout pilots, notice nothing unusual when flying at 18,000 feet.

The Air Medical Investigation Committee not only gave assistance in France as well as in England to experimental work which had been undertaken by medical men and physiologists both in and out of the military service, but at the close of the war formally offered its services to the President of the Air Board, to whom it has supplied further expert assistance.

It is to be noted, therefore, that the standards for all the tests reported were worked out in the first instance upon successful flying officers, and that all deductions are designed to aid in clinical examinations and not in any way to supplant them.

Cornerstone Is Laid for First U. S. Airway

Washington.—The anniversary of Abraham Lincoln's birthday was celebrated at Bolling Field by the laying of the cornerstone of America's first airway, extending from Washington to Dayton, O. The ceremony consisted of installing on Bolling Field the identification mark "D. C. 1" at the starting point of the Pioneer Airway.

This is recognized as a milestone in the progress of American aeronautics. It was predicted by speakers that this pioneer route will provide a model for the development and expansion of other definitely marked airways throughout the country.

In connection with the simple ceremony the Army Air Service exhibited publicly for the first time the "American Messenger Airplane," a midget of the air developed by the engineering branch of the service and built by the Lawrence-Sperry Aircraft Company of New York. The wing spread is twenty feet and the plane stands seven feet high. It will carry a load of 240 pounds and with its 60-horsepower motor is capable of a speed of ninety-five miles per hour, covering thirty-two miles on a gallon of gasoline.

FOREIGN NEWS

Commercial Air Pilots Association of Canada

Commercial aviation in Canada has taken a new step forward with the formation of an association composed entirely of holders of a commercial air pilot's certificate. The idea of forming a league of commercial pilots has recently been under consideration by enthusiasts at Camp Border and the matter has now taken concrete shape.

A constitution has been drawn up; temporary executive officers have been elected, and a campaign is now in progress with a view to enlisting the help and co-operation of all commercial pilots in Canada.

The object of the association, according to the Constitution is "the promotion of the general interests and the elevation of the standard of the profession of commercial air pilot by promoting the general interests of pilots, standardizing the efficiency of the profession, and by passing any necessary resolution to lay before the governing body of aviation in the country."

The temporary executive officers are: President, W. R. Maxwell, Flying Officer; Western Vice-President, A. G. McLerie, Pilot Officer; Western Vice-President, Major J. Scott Williams; Secretary-Treasurer, Flight Lieut. G. A. Thompson.

Aero Club of Canada's New President

Col. Thos. Gibson, well known Canadian, interested in many financial companies and undertakings, was elected president of the club at the last annual meeting.

Seaplanes to Fire Torpedoes in Test

Experiments with torpedoes fired from seaplanes at warships will be made soon by French naval experts. If the trials are successful, self-propelled torpedoes will replace bombs aimed at war vessels from the air, it is predicted, bringing about important changes in naval tactics.

The former Austrian cruiser, Prince Eugene, surrendered to France under the peace treaty, has been placed at the experts' disposal. The torpedoes will be fired at the surface of the water and close to the course of the ship, wherefore, because of their intricate mechanism, they will automatically swerve in the direction of the target.

Expenses of Aerial Service

In the course of a statement in the French chamber recently, the assistant secretary of aviation stated that the cost of upkeep of aerodromes, hangars, repair shops, meteorological and wireless stations on the French portion of the Paris-London service was estimated at 20,000 francs per kilometer as against the cost of 50,000 francs per kilometer for a single line of railway. He thought that in the future the total cost of organizing an aerial service would be 10,000 francs per kilometer. On the other hand, he emphasized the difficulties due to present heavy charges on flying plant, the French calculation of the life of an aeroplane being 200 flying hours, which meant that about 3.50 francs per kilometer had to be added to the total cost of the service. This, however, he had hopes of seeing reduced.

Flying Sickness

A peculiar account is given of two theories to account for flying sickness and of the experiments on which these theories are based. The French school, headed by Professors Bert and Regnard, holds that it is caused by shortage of oxygen, while the Italian school, led by Professor Mosso, maintains that shortage of oxygen does not of itself account for the sickness, but that collapse is due to lack of carbonic acid in the blood at high altitudes. Up to 9,000 meters, application of oxygen will overcome the sickness, but above that height a mixture containing carbon dioxide and oxygen is necessary.

Chinese Progress

In the extension of the air service between Pekin and Shanghai which is down to commence in May, Vickers-Vimy machines are to be used. These will have a capacity of ten persons besides mails, and will be under the direction of Colonel Holt, who has been loaned by the British Government to the Chinese Government for the purpose. Besides the aerodromes at Pekin and Tientsin, the others being completed are at Tsinan, Suchow, Nankin and Shanghai. The journey, from start to finish, is expected to occupy twelve hours.

German Progress in Aviation in 1920

In reviewing the progress of German aviation during 1920 the Handley Page correspondent considers that German aviators have cause for jubilation in view of the undoubted difficulties experienced by the industry. The press generally views the position with satisfaction and points out to the German public that in spite of the paralyzing methods adopted by the inter-allied Commission on aviation the following services are in existence:—Berlin, Bremen, Hamburg, Muenster, Magdeburg, Leipzig, Munich, Augsburg, Nuremberg, Stuttgart, Konstanz and extensions to Denmark, Sweden and Holland.

Associations of all kinds are being urged to insist upon absolute freedom in the air for German aviation in order to stiffen the Government in their negotiations with the allies. Meanwhile there are indications of still greater activity during 1921, a service between Magdeburg and Breslau has been inaugurated and Cologne is waking up to the fact that it should be the center for aerial transport in Western Germany. An agitation is already on foot to establish an extensive airport there on the lines of that adopted for Bremen, provided, of course, that the allies do not put a veto on the proposal. At the moment airships are under a cloud and public interest is centered in aeroplanes. It is reported that 1921 will see the adoption of heavy oils in place of the expensive petrol for motive power and inventors are busily engaged on devices for reducing the consumption of fuel.

A Germano-Swiss Aerial Agreement

The German-Swiss aerial agreement, which is, however, only of a provisional nature, has been signed at Berne. It concerns cross-traffic with such civilian air-craft officially registered by the two parties to the agreement.

The compact secures each signatory the right to cross the territory and waters of the other nation in times of peace, and also determines the spots where landings may be effected.

Aeroplanes for Winter Resorts

The Sablatnig firm has just brought out an aeroplane fitted with skis instead of wheels to enable the start and landing to be effected without danger in the snow. Limousines so fitted, and able, to carry a number of passengers, will be sent to the chief German winter-sport resorts to give exhibition flights.

Spanish Height Record

Lieut. Gonsalez, a cadet at the School of Aviation, Seville, went up for his height test, and after climbing for an hour discovered that his altimeter was not working. He continued, however, to climb as high as he could, and then landed safely.

The sealed barometrograph in the machine was examined and it was discovered that the pilot had attained a height of 5,700 meters, thus breaking the Spanish height record.

Monaco Seaplane Meeting

At the Monaco Meeting, April 13 to 20, an ambitious preliminary programme of events is announced. April 15-16 will be devoted to a 492-kilometer test, Monaco-Ajaccio-Monaco, in which each competitor will carry a dummy mail post for Ajaccio, where he will again take on another dummy post for return to Monaco, the control providing for a maximum time out and home of twelve consecutive hours. Prior to the race preparatory tests must be made, consisting of a 2,000 meter climb, with 200 kilos. of ballast, within 45 mins.

April 19 there will be a shorter race—Monaco-Cannes-San Remo-Monaco, twice, a distance of 284 kilometers. For this speed seaplanes and commercial machines each have a category to themselves, the latter competing in the morning and the racers in the afternoon. The Eliminatory test for this consists of a 3,00-meter climb in one hour, and the competitors will have to take off from the water.

April 17-20 a speed race, Monaco-Cannes-Monaco-Mentone-Monaco, about 125 kilometers; starts from the water. During the whole meeting in the morning between 11 and 12 speed races will be the order of the day over the mile and for climbing, whilst other contests are provided for in connection with skilful alighting, etc. The prize fund amounts to 160,000 francs in money.

Aircraft Versus Battleship

The ex-German superdreadnought Baden has been sunk at Spithead as a result of experiments by the British naval authorities. The vessel has been a target for bombing by aircraft. It is understood the Admiralty proposes to salve the vessel which is in shallow water in preparation for a further series of experiments.

In view of the controversy as to the future of capital ships, the tests are considered highly important and the results obtained are expected to influence the decision of the imperial conference on naval construction.

Up-to-Date

The manager of the Palace Hotel, Southport, England, appears to possess unusual foresight and originality. In his advertisement of the establishment, the following announcement is made: "Aeroplanes to and from hotel."

British Aircraft-Carrier Accompanies Fleet in Maneuvres

On January 17th the Atlantic Fleet left Portland for an extended cruise in Spanish waters. H. M. Aircraft-Carrier "Argus" accompanied the Fleet. Practise attacks were made by submarines and aircraft during the journey down the Channel.

Seaplane Service at Riviera

It is reported that a seaplane service, employing Savoia machines, will be in operation shortly at the Riviera. Three of the above machines will be delivered to the Transaérines Tourisme et Messageries at Antibes by air from Sesto Calende, Italy.

Zeppelin L.61 Wrecked

The Handley Page Berlin correspondent reports that details of the recent accident to the famous Zeppelin No. 61, which was safely delivered to the Italian Military authorities a short time ago, have now reached the German aviation clubs. It appears that the airship was on a trial flight in the neighborhood of Rome recently, when a serious smash occurred owing to an unexplained dislocation of the steering gear on an attempt being made to land. Three members of the Italian crew were killed on the spot and several others severely injured. German experts declare that the Italian authorities were unable to make good the extensive damage in the Government workshops and applied to German aeronautical engineers for the essential parts and accessories to replace those which were wrecked. The request was, however, refused on the ground that it would be contrary to the provisions of the Treaty of Peace to supply any of the allied Powers with airship parts as all had to be destroyed without exception. The Italians are then said to have tried to induce German engineers and mechanics to undertake the repair of the derelict but without success and it is now related with ill-concealed satisfaction that the Italians have had to decide upon scrapping the monster—once the pride of the German nation. The public is also being reminded that the airship was safely navigated over the Alps by a German crew and delivered intact to Italy. It is also pointed out that German aviators and engineers remained with it for weeks in order to properly instruct the Italian crew. It is even suggested that a similar fate is reserved for the airships already delivered to England, France and Japan under the Peace Treaty as on no account whatever will Germany supply machinery or parts that may be damaged.

Surrendering of German Aircraft

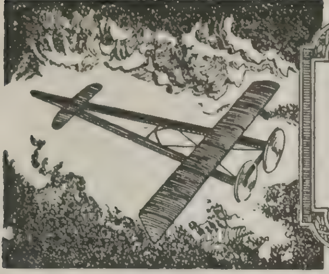
On December 17th the Reichstag, in three readings, accepted an Act on the registration of all aviation material that has not been delivered up, despite the announcement of the Federal Chancellor of the Exchequer setting a definite date for this by August 5th last. A new term of grace has now been determined on, after the lapse of which fines of a maximum sum of 10,000 marks or prison will be imposed on all offenders.

Good Business Record

Some interesting statistics have recently been issued by the Deutsche Luftrehdere. During the period February 5, 1919, to November 26, 1920, the machines belonging to this Society completed 6,208 flights, covered an aggregate distance of one million kilometers, carried 5,545 passengers, and some 33,000 kilograms of freight.

Lottery Suggested to Stimulate Aeronautics

With the idea of giving practical assistance to commercial aviation in Italy, and also to stimulate popular interest in the industry, the Italian Aero Club is proposing to organize a huge lottery. The price of the tickets has been fixed at two lires, and while there will be some cash prizes, the great bulk of the prizes will be in the form of tickets for flights, of varying lengths, over existing or projected aerial lines. A somewhat similar scheme has been put forward in France.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

A Hydroaeroplane Flying Model

LIGHTNESS is the most striking feature of the hydro flying model designed by Mr. W. F. Schult, a former member of the Concord (Massachusetts) Model Aero Club. Only by a careful consideration of the function required in every structural member employed, has the unusually light weight of 2¾ ounces been achieved in a hydro model with a 24-inch frame.

The float or pontoon arrangement is original and works very satisfactorily; a run of not more than twenty-five feet is sufficient for the model to get off the surface of the water. Twin pusher propellers revolving in opposite directions are each driven by six strands of ⅛″ flat elastic, totalling in length 24 feet. The rubber elastic motors can be given 800 turns, which will keep the propellers (measuring 6″ in diameter and 6″ in pitch) rotating for 20 seconds duration. Attempts have not been made for distance flights, as the designer has experimented principally with take-offs from the water, and proper balance during flight.

One of the difficulties encountered was in lining up the small auxiliary floats, for if one has even a slightly greater inclination than the other, the machine will turn in the air, the floats acting similar to ailerons in causing one end of the wing to lift while it depresses the other. The central or main pontoon has a flat bottom parallel to the flight line. The auxiliary floats are fixed at a slight lifting angle, their purpose being merely to steady the machine laterally until the lifting speed is reached.

Dimensions

Span of main wing	18⅜″
Span of front wing	8 ″
Chord of main wing	3⅛″
Chord of front wing	2 ″
Frame length (without propellers)	24 ″
Height over all	4½″
Main pontoon length	15⅜″

List of Weights (Ounces)

Complete frame with pontoons	1.17
Main wing	.50
Front wing	.20
Elastic motor (24 feet)	.66
Propellers, two (each 7.5)	.15
Total weight	2.68

The rubber used weighs .0275 ounce per foot. Including four rubber bands to attach the wings to the frame, the actual total flying weight comes to slightly less than 2.75 ounces, or 2¾ ounces.

The accompanying three-view outline is exactly 1/6 of the actual size of the model. This will be found to be a convenience for those who wish to reproduce the machine. It will be noticed on the drawing that the center of gravity occurs about 14 inches from the front of the frame; below this point the rear edges of the small floats are situated. The C.G. location will, of course, occur slightly ahead of this point if additional rubber strands are used. The main wing leading edge should be located 7⅝″ from the rear of the frame, although the drawing shows it to be forward of this. The front wing has an incidence or lifting angle, obtained by elevation blocks 3/16″ high.

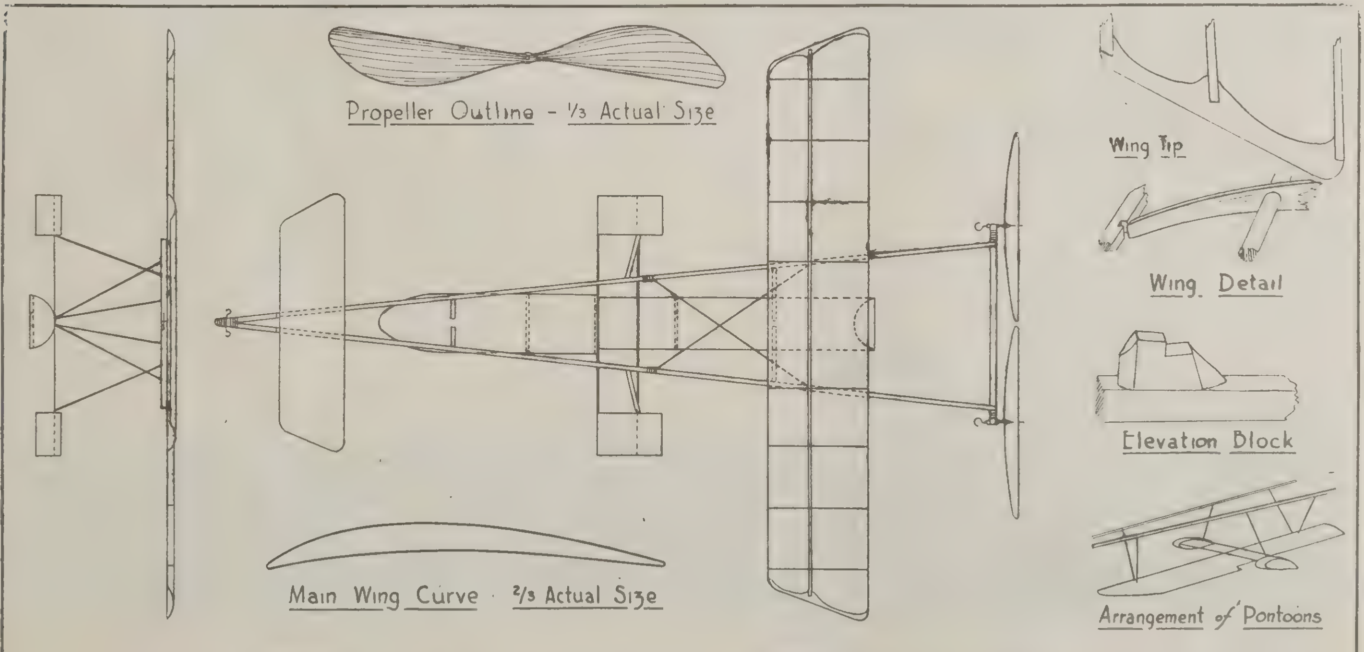
Frame Construction

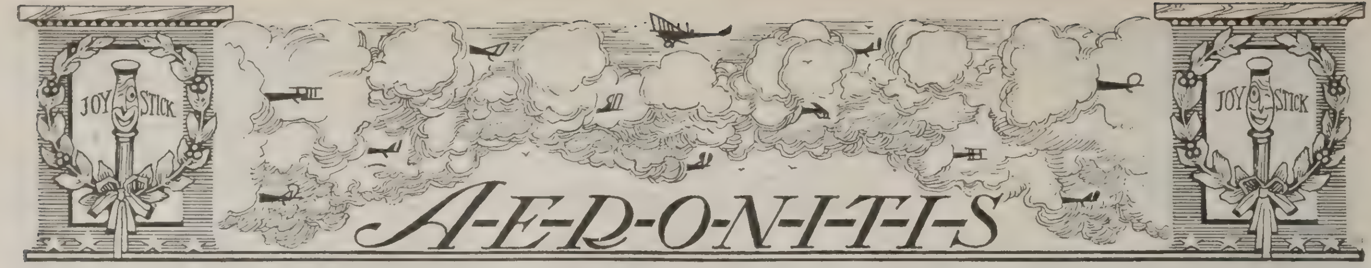
The A frame is composed of 3/16″ x 3/32″ spruce with a propeller brace of the same material. Propeller bearings of brass tube with shafts parallel to the flight path. The X brace is of 1/16″ round reed, bound at ends with silk thread.

Braces to pontoons 3/16″ x 1/16″. These, as well as all others float braces, are attached by means of Amberoid cement and no thread wrapping is required.

(Next week's issue will contain photograph with wing and pontoon description.)

(To be continued)





A-E-R-O-N-I-T-I-S

When the Last Aeroplane Is Builded

When Earth's last aeroplane is builded,
And the motor is rotten with rust,
When the oldest Pilot's departed,
And the youngest Student is "bust,"
"We shall rest and, faith, we shall need it—
Lie down for an eon or two,"
Till the master of all good pilots
Shall set us to flying anew.

And those that flew DH's shall be happy:
They shall sit in a wicker chair,
With others to do their "meching" for them,
And sweat and tear their hair.
They shall find that the pick of the job are theirs,
With men at their beck and call;
They shall fly for an age in the new ships,
And never be tired at all.

And no one shall fly for money,
And no one shall fly for gain,
And no one shall fly for Honor,
And no one shall fly for Fame—
But each for the joy of flying,
In the light of the sun and the stars,
Shall do all the stunting he wants to do,
Like "A little Tin God in a Car."

By John C. Columbus, *with apologies to Kipling.*

Sad

There was a young pilot named Johnie,
Who flew in a monstrous Caproni,
He tried to do stunts,
And he tried only once,—
Now six feet of earth lies o'er Johnie!

By John C. Columbus.

"Flying Without an Aeroplane"

One day Jacob and Joseph, two junk dealers in a Western town, saw an aeroplane for the first time in their lives.

They watched it eagerly, and after several minutes Joseph said: "I'd like to be up der, mit dat airship."

Jacob took a doubtful glance at the aeroplane, and then said to Joseph: "I'd hate to be up der mitout it."

E. F. G.

Things That Will Never Happen

1.—Ex-soldier receives prompt reply from his letter to the War Risk Insurance Bureau.

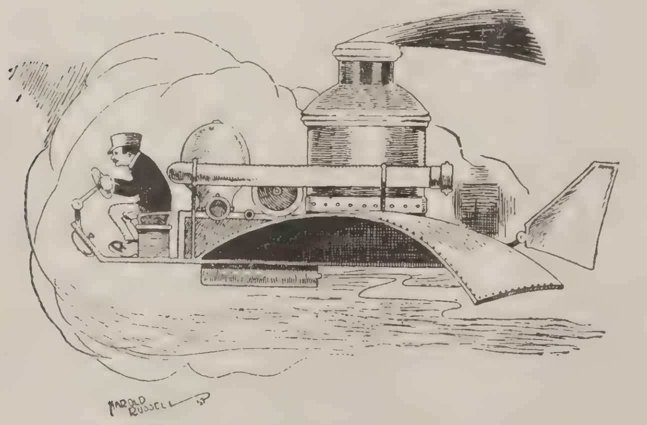
2.—Japan will accept with enthusiasm a plan of universal disarmament.

3.—A recruiting sergeant will answer truthfully when asked by a prospective, "Would you advise me to join up?"

4.—A second lieutenant just graduated from West Point will not bawl out a private who has failed to salute him.

5.—Bonus bill will pass the Senate by a unanimous vote.

6.—Grover Cleveland Bergdoll will surrender himself.



INSECTS.
"A Firefly."

Solved

"I know that the big boats are battleships," informed the jane to her sailor sweetie, "but what are those small boats?"

"Those are tugs," said the gob politely.

"Oh, yes; I've heard of them—tugs of war," returned the jane.

Information

Dear Mr. Editor:

I am in love with a pretty and intelligent girl, but she's one-legged. Do you think this makes any difference?

I. B. Aboob.

Answer: Not at all. Think of the money you will save on silk stockings.

But What's in a Name?

Now that the nation is dry, an enterprising dopeologist has compiled the following for the benefit of summer vacationists: Rye, N. Y.; Bourbon, Ill.; Green River, Ky.; Cliquot, Mo.; Champaign, Ill.; Brandy Keg, Ky.; Brandy Camp, Pa.; Brandy City, Cal.; Port, Okla.; Sherry, Texas; Brandywine, W. Va.; Ginn, Miss.; Wine, Va.; Tank, Pa.; Booze, Tenn.; Drinker, Pa.; Aqua, Va.; Vichy, Mo.; and Lithia, Fla. Take your choice. —*The Wheeling Register.*

Now It Can Be Told

The timid doughboy, on his first day under fire, left his company unceremoniously and fled rearward. He had covered a lot of distance before he pulled up at the command of a portly soldier:

"Halt, there! Where are you going?"

"Oh, I'm just going. Who are you?"

"I'm General Richardson."

"Holy smokes! I didn't know I'd run as far as that!"

There was a young man from (deleted)
Who up in an Avro was seated,
"Some" bombs he threw down
On Metz-Sablon town
That it's output was sadly depleted.

No Improvement

Johnson and Jackson are not now on speaking terms. It all arose as the result of an argument which required some mental calculation.

"I tell you," said Jackson, "that you are altogether wrong."

"Pardon me, but I am not," replied Johnson.

"Didn't I go to school, stupid?" almost roared his opponent.

"Yes," was the calm reply, "and you came back stupid."

After the War

An Army recruit went on parade one day with six medals on his chest.

"Ah!" said the officer, "you have seen service."

"No, sir."

"Then what are those medals? You have no right to them."

"Shure, an' I have! Didn't me pigs win first six prizes at Torkington Show?"

Deep Stuff

There has never been a single word to cover the wordy operation of "putting up an umbrella." Apropos of nothing at all, the Technical Department suggests "marouflaging," which we find in aviation nomenclature is the protecting of wooden members from moisture.

Mock Turtle

Reporter—What did you eat when you came down in the desert?

Observer—Soup. We hit a rock and the old bus turned turtle.

Drop Him Easy

"Stop the airship, mate; I've got a passenger who refuses to pay his fare."

AERIAL AGE
WEEKLY

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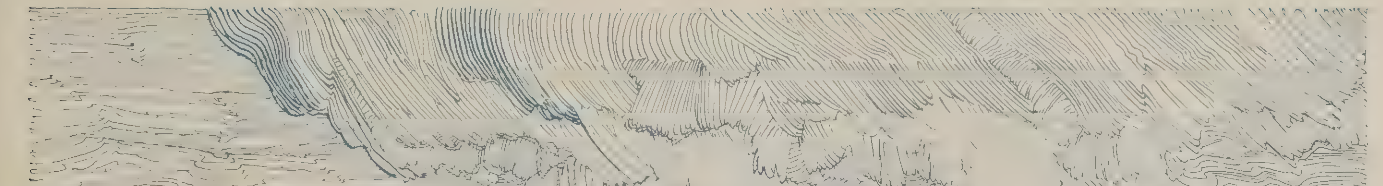

Now, Uncle Sam, If you had your say How would you send your Mail-
By Aeroplane and save a day, or Would you use the snail?

Secretary Daniels Urges Aeronautic Development

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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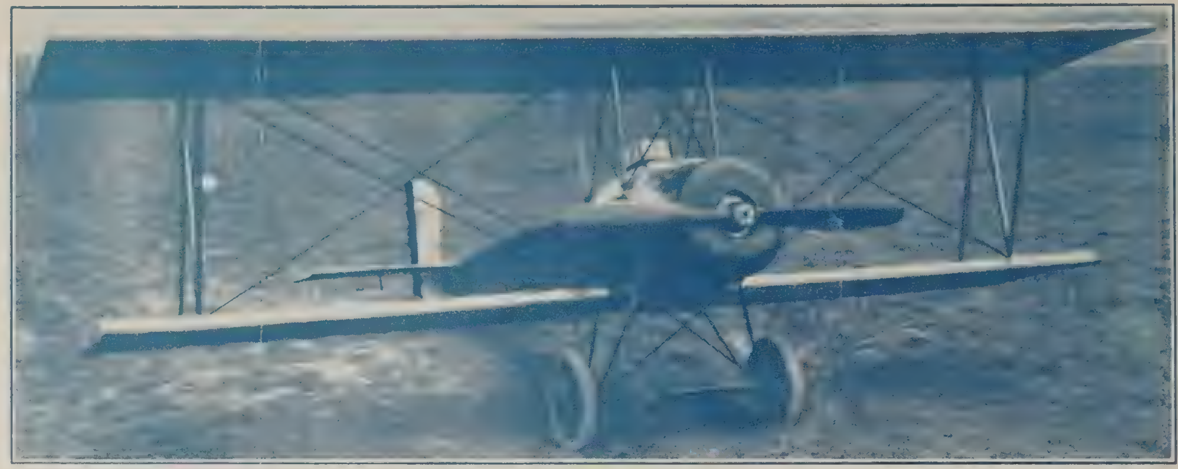
"The Marvel of the Air"



1921 Model Sport-Farman

The Sport-Farman is a small two-seater weighing only 450 lbs., Manufactured by H. & M. Farman, Billancourt (Seine), France, in the largest aircraft factory in the world.

It has been perfected by 15 months of continual flying. Its marvelous performance record is unapproached by any airplane in existence. At Etampes, France, in July, 1920, the Sport-Farman established an official World's record in the low-high speed contest conducted by the Journal l'Auto.

Low Speed . . . 15 5-8 m.p.h.
High Speed . . 87 m.p.h.

It is economical, can be housed in the smallest hangar or shed, easy to pilot, no need of special mechanics.

There is a Sport-Farman landing field in *your* town. Immediate deliveries.

Write for booklet containing full information.

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**THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY**

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SECRETARY DANIELS URGES AERONAUTIC DEVELOPMENT

SECRETARY DANIELS in a letter addressed to Senator Page, chairman of the Senate Naval Affairs Committee, takes a position favoring development on a proper scale of the naval air service. Mr. Daniels's position urging additional appropriations for naval aircraft is supplementary to his stand in favor of the continuation of the capital ship programme.

"It is of paramount importance," says the Secretary "that the navy be equipped with suitable aircraft and that the aircraft, operating with our fleets on and under the sea, shall not be inferior to those of any country in the world. Indeed, we should lead in development as we led in conquering the air."

The Secretary takes exception to the fact that no appropriation is made in the new naval bill for construction of new aircraft or new projects. He urges an appropriation for this purpose of $22,259,590. He also urges the importance of appropriating money for construction of aeroplane carriers which shall accompany the fleet.

Urging this appropriation Mr. Daniels said: "The prime duty of the navy at this hour is by experiment and development and construction to perfect fighting ships in the air. The naval bill which passed the House and which is now before your committee carries a total of only $6,913,431 for naval aviation. This sum is allocated for the maintenance of activities as they now exist or are planned, practically nothing for experiment and development on a scale commensurate with its importance.

"No appropriation is made for the construction of new aircraft or for new projects. I do not think it was the purpose of the House to cut the aviation appropriation to so small an amount as was contained in the bill, because the Naval Committee of the House unanimously recommended the appropriation of $8,914,750 for new construction. However, the bill approved by the Naval Affairs Committee has not been considered by the House, and my information is it will not come up at this session of Congress.

"Therefore, it is necessary, if our navy is to have even a respectable strength in the air, that the Senate shall make such increase of appropriations as is absolutely necessary. Careful consideration has been given to the matter and the smallest amount that will enable the navy during the next fiscal year to conduct its operations, developments and experiments on a scale commensurate with its importance will be $22,259,590. This sum is absolutely necessary unless we shall go backward in aviation instead of going forward.

"The limited funds contained in the House bill would make it necessary to abandon the erection of a rigid dirigible in this country. This ship has been authorized by Congress, and a considerable sum of money has already been spent upon the design of the vessel and on the procurement and the fabrication of materials for the construction thereof. The joint board of the army and the navy has placed the developments of rigids in the hands of the navy, and the abandonment of this project would involve the abandonment of the lighter than air development in so far as the construction of rigids in the United States is concerned, carrying the wastage of the money already expended upon this vessel.

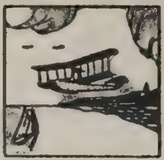
"Unless there is an increase of appropriations for aviation there will be no funds available to supply modern radio equipment to our aircraft. I need not speak of the importance of securing ready communications between aircraft, surface and subsurface vessels.

"I wish to urge upon your committee the importance of appropriating for the construction of aeroplane carriers, vessels regularly equipped for carrying planes in connection with fleet activities. The best experts in this country and abroad believe that unless vessels of this class are placed with the fleet full power of organization cannot be developed, and our forces would be at serious disadvantage if engaged with forces of other nations provided with these essentials to a fleet.

"The department feels that failure at this time to provide the fleet with adequate aircraft would be to deny it what is recognized as an essential part of a modern fleet. Indeed, without suitable aircraft and aircraft carriers, our great fleet would not only lack its eyes, but would be seriously handicapped and could not develop its full power needed in war.

"Economies should be effected everywhere possible, but I venture to submit that it would not be economy to cut to the bone in that new arm of naval service which some of the ablest naval experts in the world believe is destined to soon become quite as effective as any other part of the fleet, if, indeed, it may not be found superior in fighting efficiency to other units hitherto deemed to be the most effective parts of a fighting fleet."

The News of the Week



Aeromarine Plane and Motor Company to Have Training School

A training school for commercial aviators will be opened on Raritan Bay at Keyport, N. J., early this spring. C. F. Redden, president of the Aeromarine Engineering and Sales Company, said that since the Navy arranged with his concern to distribute the HS-2 Navy patrol flying boats which the Government has released with the idea of developing commercial flying, many inquiries have been received from sportsmen and others concerning instruction for pilots.

Students at the Aeromarine School will receive instruction in both land and water flying craft, particularly straight flying and navigation necessary in operating passenger-carrying machines. Rest rooms and class rooms are being provided near the factory of the company. Students will also have an opportunity to learn the methods of aeroplane construction through practical application in the various workshops.

"There will be special classes in this factory work," said Mr. Redden, who thought the school would be formally opened in April.

"Organization of a training school for aviators desiring to fly commercial aircraft provides New York with one of the most elaborately equipped special training schools in the country. This is the second school to be established on that site. During the war the Navy Department established a school for carpenters' mechanics and used the aeromarine factory as a class room for Government workers. Navy pilots were sent there for construction work and training in piloting the smaller types of seaplane. The property includes sixty-six acres with sixteen buildings, a club-house, restaurant, engine plant, assemply building, a seaplane station and a flying field for land machines."

A Whirlwind Drive for Members

Mr. Harry Rouclere, the flying hotel man of Ridgewood, N. J., will pilot a two-passenger Curtiss aeroplane in the early spring to promote the membership drive for the New Jersey State Hotel Association and distribute copies of the "Hotel Pilot" in different parts of the State.

The Easter number of the magazine will be a special New Jersey booster number. It will also contain information about hotels of cities bordering on the State, as well as considerable matter regarding advantages of membership in the New Jersey State Hotel Association.

Balloon Forced to Land

Meriden, Conn., Feb. 16.—A balloon with three passengers from the naval station in Norfolk, Va., made a safe landing at noon to-day on a farm in the west section of Meriden. The balloon left Norfolk yesterday on a short trip, but the wind shifted and carried the balloonists north, and last night the huge bag was still making rapid progress. Since daylight the men were on the lookout for a landing place, and, fearing they were getting too near the Atlantic, finally decided to come down. They struck trees in landing, but no serious damage was done.

The balloon was in command of Lieut. S. N. Woodford, and his companions were Lieuts. A. T. Sewell and J. P. Worthington. They suffered no serious discomforts.

Planes Can't Fly Over Tampa Sunday Mornings

Tampa, Fla., Feb. 11.—Aircraft must not fly over this city during hours of worship on Sundays, according to an order issued today by the city commissioners, as a result of complaints that aeroplanes soaring low over churches last Sunday so disturbed the congregations that many members were deprived of the benefit of spiritual advice from the pulpits.

Kansas to Have Air Law

State regulation of aviation is provided for, with the creation of an aviation department of the state government, in a bill which is to be introduced in the Kansas senate at the present session by Senator R. C. Howard, of Arkansas City. Senator Howard is serving his first term in the senate, but has been in the representatives' end of the state house before.

Senator Howard's bill will provide for aviation fields at various points in the state, under state regulation; the licensing of pilots in the state under rules to be set forth by the aviation department, and inspection of all planes by state inspectors.

An Airscape of Rio de Janeiro

Endurance Flight Spoiled by Mishap

Mineola, Feb. 16.—Lieut. Ross C. Kirkpatrick, U. S. A., unfortunately failed in his second attempt to make a new record for heavier-than-air endurance flying after circling Mitchel Field, 11 hours and 21 minutes.

His Curtiss Eagle biplane with a Liberty motor ascended at 7:34 A. M. The flyer was compelled to descend at 6:55 P. M., when a cracked generator was shaken loose from the crank case of the motor.

Lieut. Kirkpatrick's flying time compares with a world's record of 24 hours, 19 minutes and 7 seconds, established last June by B. Boussoutrut in France, and with the American record of 20 hours and 19 minutes, held by the navy.

The aviator's previous attempt last December was of 18 hours and 4 minutes' duration. He was compelled to abandon the effort because of a leaky gasoline pipe.

Lieut. Kirkpatrick had been overhauling his plane more than a week, and when he ascended, accompanied by Max Goodenough as mechanic, it was in perfect condition. He carried gas and oil for thirty-six hours, and had planned to stay up until 7 P. M., February 17th.

The lieutenant said he would make another effort as soon as he could gain permission from the Department of Military Aeronautics. He attributed the accident to excessive vibration caused by the slow speed at which he flew which snapped the bolt connecting the generator to the crank case.

Official observers for the Aero Club of America were present at the start. They were Major Henry J. F. Miller, Captain Harry Smith, and Lieutenant John P. Roullet.

Lieut. Kirkpatrick is one of the flyers who made the recent trip from Mitchel Field to Alaska and return.

Missing Aviator is Safe

Sanderson, Texas, Feb. 16.—Lieutenant Alexander Pearson, Jr., army aviator, who has been missing since February 10, rode into Sanderson to-night. He had been without food for three days and had ridden bufros, walked, swam and floated down the Rio Grande before reaching here, according to his story.

Pearson said he was forced to land in a desert-like area in the Big Bend country. The new crank shaft of his machine failed to work properly, he said, and forced his descent.

"I was forced to land near the Rio Grande after I had gone about 250 miles," Lieutenant Pearson said. "My engine went dead and I had to abandon it. There was plenty of gasoline in the tank. The machine is undamaged and is lying near the river."

Not a sign of human habitation was visible. He waited until the water in his engine had cooled, drew off some for drinking purposes and set forth to find some means of communication. He had no food with him.

The next morning a sandstorm almost blinded him as he trudged wearily across the desert. The third day was a repetition of the second, he said. The unabated wind hurled cutting sand into his face and temporarily blinded him. Late in the afternoon he reached the Rio Grande. Too tired to swim, he lay down on the bank and went to sleep.

On the morning of the fourth day he plunged into the river, and, with the aid of a floating log, swam downstream. He had been in the water almost an hour, he said, when he saw two ranchmen. They helped him to climb from the water, gave him some food and a burro and escorted him here.

He said he expected to leave to-morrow for El Paso, where he will report to aviation headquarters at Fort Bliss.

The flier could not say whether he would attempt to carry out his plans for the transcontinental flight, but thought that probably would be decided when he reached El Paso.

Detailed to Go to Italy to Bring Back the "Roma"

For the purpose of bringing back the giant airship "Roma," recently purchased by the United States from the Italian Government, the following officers and men from the U. S. Army Air Service have been detailed to go to Italy: Major John J. Thornell, A. S.; Captain Dale Mabry, A. S.; 1st Lieutenant Walter J. Reed, A. S.; Master Sergeant Harry A. Chapman; Staff Sergeant Marion J. Beall; Sergeant Joseph M. Budenbach; Corporal Virgil C. Hoffman.

Of the semi-rigid Usuelli type, the "Roma" is believed to be the largest semi-rigid airship in the world. Sold to the United States Government for approximately $200,000, it would cost at present to duplicate probably $1,250.000.

Designed originally for commercial purposes, the "Roma" was built by the Italian Government for use during the war. The big airship was constructed under the direction of Signor Usuelli, whose name designates the type, and of the Engineers Prassone and Nobile and Colonel Crocco.

The "Roma" has a capacity of 1,200,000 cubic feet; is 410 feet long, 82 feet wide, 88 feet 6 inches high, and has a cruising radius of 3,500 miles at full speed.

Equipped with six 12 cylinder Ansaldo engines of 400 h.p. each, the "Roma's" speed is estimated to be 80 m.p.h.; her gross lift about 65,000 pounds, or 32.5 tons; her disposable or useful load, about 38,000 pounds, or 19 tons, which is 58% of the gross lift.

The "Roma" has carrying capacity for 100 passengers in addition to the crew.

In the U. S. Air Service Magazine of June, 1920, Lieutenant Colonel A. Guidoni, Air Attaché, Italian Embassy, gives a detailed description of the "Roma" as follows:

"The envelope has twelve divisions for the gas tanks and only six for the ballonet. A characteristic of this airship is that each of the ballonet divisions has its own manifold and two controllable exhaust valves.

"In the bottom of the envelope and under it there runs, from fore to aft, a rigid triangular girder with the apex down. This girder has a 12 degree side and the small parts are made out of steel pipe, having articulated couplings to avoid all stresses of secondary flexion and to assure that they will work in a satisfactory manner.

"The top of the envelope is bilunated, much after the fashion of the Astra Torres, but of smaller proportions. Crossing the main beam, there are three longitudinal fabric frameworks in which the supports are attached to the couplings of the girder by means of parabolic ropes.

"In order to make rigid the nose of the ship in flight, the fore part of the girder is shaped in a large braced cupola. There are six 12-cylinder 400 h.p. Ansaldo engines placed in pairs near the fore, the center and the after parts of the ship. Engines and radiators are situated on cantilevers projecting from the central beam.

"The engines of the forward group have the axle at an inclination of 12 degrees over the diametrical plan of the ship; the second pair have an angle of ten degrees, while the third have the axle parallel. This is arranged so that the workings of the different groups of engines do not interfere with each other.

"The propellers have a diameter of 3.50 m., and are directly connected to the engines. There are three fixed rectangular planes and a triplane with elevators. The cabin control is in the girder. For the steering of the ships there are two control wheels, one fore, the other aft."

The airship will be deflated and brought to the United States by transport.

Air service detail going to Italy to bring back the airship "Rome." Front row (left to right): Lieut. W. J. Reed, Major J. G. Thornell, Capt. Dale Mabry; (second row): Sgt. J. M. Budenbach, Sgt. V. C. Hoffman, Staff Sgt. M. J. Beale, Master Sgt. H. A. Chapman, and Master Sgt. R. C. McNally

The AIRCRAFT TRADE REVIEW

Jacuzzi Bros. to Operate Airway

Jacuzzi Bros., aeroplane manufacturers of Berkeley, Cal., are planning next spring to establish an air passenger service between Richmond, Oakland, San Francisco and Sacramento, it is announced through the Chamber of Commerce of San Francisco of which the brothers are members. It is proposed to put a six-passenger plane in this service and to maintain a regular schedule.

Aircraft Union Station

Arrangements have been completed whereby the air passenger service of San Diego and Los Angeles aviation companies will exchange landing rights. Business men and pleasure seekers can now make the trip in approximately an hour and three-quarters.

Edward Stevens, president of the Air Passenger service, and Pilot D. R. Matthews made the flight to Los Angeles last week to procure spare parts for the passenger planes. They were absent from the local field on Dutch Flats just five hours and twenty minutes, including the time spent in making their purchases in Los Angeles.

Mr. Stevens says that the outlook in the aeroplane passenger business is exceedingly good, and that his force is now engaged in assembling a second Curtiss Standard ship.

New Aeroplane Tire

Goodyear has developed new tires to take the shock of landing huge planes of approximately six tons' weight. Several of the new 44 x 10 cord aeroplane tires have been made and approved by the Glenn L. Martin Co. for use on the big Martin Bombers that will be placed in the service of the government. Goodyear has received an order for 76 of these new type tires.

Development of these aeroplane tires called for more real skill and brought up more complex problems than the development of the giant pneumatic cord truck tires.

Where pneumatic tires are built for traction and to sustain constantly heavy loads, the cord aeroplane tire required resiliency as its predominant characteristic, and yet needed the strength to sustain the shock of one of the 12,000-pound planes landing at a speed of approximately 40 miles an hour. The problem of development was difficult, as can be realized from the fact that each of the aeroplane tires is required to sustain at each landing more weight per tire than is supported by pneumatic truck tires of equal size.

The engineering problem was almost that of the truck tires reversed. Despite the fact that the aeroplane tire has fewer plies than the truck tire, has practically no traction tread except for a thin strip of rubber to prevent actual wear of the fabric, weighs but 47 pounds without tube or rim, and is inflated to but 75 pounds, it has proved its ability to sustain the tremendous shock of the Martin Bombers upon landing.

To Deliver by Aeroplane American Mail in Germany

The Steamer Mount Clay, from New York February 19, will carry mail for aeroplane delivery to Berlin and Rhine points in Germany, according to an announcement by the Post Office Department.

The mail will be delivered from the ship to a German hangar in Cuxhaven for forwarding and matter intended for such transmission should be marked "Dispatch by air from Cuxhaven."

The announcement said similar deliveries are to be arranged with German officials in connection with other sailings.

New Metallurgical Laboratory Apparatus

Catalogues have recently been received from the Eimer and Amend Co. illustrating a line of new metallurgical laboratory apparatus. One of these is the multiple replaceable unit electric furnaces for experimental heat treatments, etc. These furnaces are constructed of patented units containing the heating coils held in by undercut grooves in the heat resisting material. One form is called the decalescent outfit for tool treating to determine proper hardening temperatures, etc.

Another piece of apparatus is the Kimley electro-analysis apparatus for the rapid determination of copper, tin, lead, zinc, etc. The stand is arranged to perform six analyses at the same time. The platinum electrodes are easily replaceable. With this apparatus, one man can handle fifteen or more samples a day, provided it is not necessary to separate antimony, if present, from the tin.

Report on Nebraska-Mexico Trip

We have just received the following interesting report which Loyd A. Winship has furnished to the American Consul in Mexico City concerning the flight of the Lincoln-Standard "Tourabout" and "Speedster" from Nebraska to Mexico City.

"The trip was made by two Lincoln-Standard Aeroplanes, one "Tourabout" and one "Speedster," manufactured by the Nebraska Aircraft Corp. of Lincoln, Nebraska. Flight undertaken at the invitation of President De La Huerta, General Obregon and the Mexican War Office for the purpose of experimentation and exploration.

The director in charge, riding as observer, Loyd A. Winship.

Pilots: Edward (Turk) Gardner, George Pufflea 1914-15-16 Chief Pilot of the Mexican National School of Aviation.

Motors in charge of A. Craft.

Substitute observers: Harry J. Lawson, Mrs. L. A. Winship.

Route as follows:

Lincoln, Nebraska, to El Paso via Junction City, Kansas, Tucumcari, New Mexico, and Oro Grande, New Mexico. Time 11 hours.

El Paso to Chihuahua, Torreon, Monterey, Saltillo, San Louis Potosi, Queretaro, and Mexico City. Time 13 hours and 30 minutes. Maximum flying altitude 16,000 feet.

Side trips made inland from Chihuahua, Torreon, Monterey and Saltillo, carrying as passengers and guests Governors, Military Chiefs, Mayors of Cities and Newspaper Men. At Mexico City complimentary rides given to members of Cabinet, Staff Officers and Military Leaders.

On December 5th at the National Aviation Field, an exhibition was given as a benefit for the Mexican Red Cross, the proceeds going entirely to that organization.

The pioneer trip from Mexico City to Tampico we made on the 1st day of January, 1921, at the suggestion of the Secy. of Communications. Leaving Mexico City we flew due north passing Pachuca to our right continuing due north for about 60 miles flying at an altitude of 16,000 feet, turning eastward after passing the last mountain peaks, striking the coast at Tuxpan, thence without landing passing over the oil fields and landing in Tampico. Time 2 hours and 45 minutes. Distance 260 miles.

Return trip: Tampico to Delores Hildago 210 miles. Time 1 hour and 50 minutes. Delores Hildago to Mexico City 200 miles. Time 2 hours and 10 minutes, flying at an altitude of 17,000 feet.

Total trip: Lincoln, Mexico City, Tampico and return 2,910 miles. Flying time 30 hours and 45 minutes. Side trips 2,400 miles. Total travel since leaving factory 5,310 miles. Total flight since leaving El Paso over unexplored mountainous territory without landing fields 4,300 miles, without changing propeller or other repairs.

The laws of Mexico do not allow the private ownership of aeroplanes or their operation. This will have to be overcome and much work will need to be done in preparing fields and training pilots for mountain travel before aeronautics can become practical in Mexico.

There are representatives here to our knowledge, of three German Aeroplane firms, two English and one French, but they have brought in no planes and have been able to accomplish nothing.

Throughout the trip we have been guests of the War Department and Department of Communications. Have met with the heartiest reception and co-operation on the part of the citizens everywhere.

We have been surprised to note by our own personal observation even in the small towns far away from the railroads where few, if any, Americans travel, in the general treatment given us during the entire length of the trip, the utter lack of the so-called Anti-American feeling, which we were led to believe in the United States was prevalent in Mexico. As further proof of the friendship for America, we found upon arrival in Mexico City, that the closest friends of the Administration were Americans, and the foreigner that enjoyed the most intimate relations with the then President De La Huerta and the present President Obregon is an American representing one of the New York papers, the New York *Times*."

SPECIAL PACKARD AERO ENGINE FOR ALTITUDE WORK

By COLONEL JESSE G. VINCENT

AN aero engine especially designed for use at high altitudes and with the compression ratio so high that it is not suitable for work with wide open throttle near the ground, has just been accepted by the United States Army Air Service. It is one of the first American aeroplane engines in which an effort has been made to offset the difficulties experienced with ordinary engines at high altitudes.

The design was completed in the Packard shops and the engine is known as the Packard "1237." That the performance of the engine will considerably exceed the specifications laid down and will be particularly pleasing at altitudes above 5,000 feet is indicated by the preliminary tests.

The difficulties of testing engines at high altitudes have had a serious and unfortunate influence on aeroplane engine design. It was entirely natural that engines should be judged by their ground performance and of course in the early days when altitude flying was in its infancy, this made little difference. But no new basis of experiment had been established until recently, although it was a well-known fact that aeroplane engines are used 90% of the time at altitudes above 5,000 feet.

This resulted in engines that were not designed for the greatest efficiency under the conditions where they did most of their work, but instead for the altitudes at which they are used only for the first few moments of a flight. In this engine, for the first time in this country, an effort has been made to provide features that might not be wholly satisfactory on the ground but would become so in rarer atmosphere. The lower air pressure in the high altitudes is, of course, responsible for the decrease in efficiency of the average engine at those altitudes. Just as the human body is best fitted for work nearer sea level and functions less efficiently at high altitudes, so the aeroplane engine, if designed to deal with sea level conditions, cannot perform so satisfactorily in the upper air.

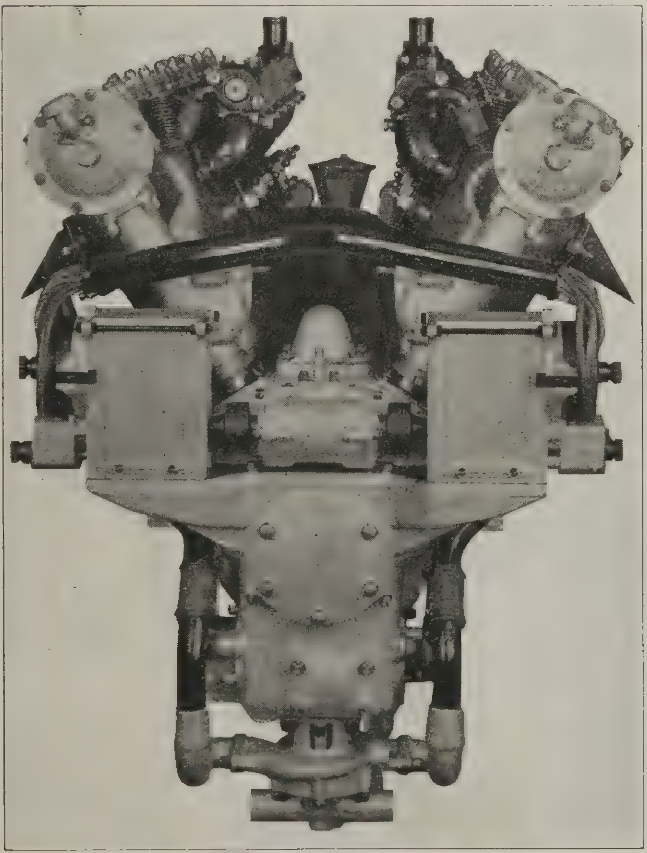
The first necessity in making an aeroplane engine efficient at high altitudes, was to increase the compression ratio. The real reason for the loss of power of such an engine in thin air is that the weight of fuel which can be consumed with a certain volume of air is correspondingly reduced, with a resultant loss of power output. The higher compression makes it possible to maintain power even at considerable heights due to improved thermal efficiency.

Since the engine is designed to work normally at high altitudes, it is also best to make the cylinders larger in proportion to the rest of the working parts. This is because the stresses on those parts are far less than would be the case at sea level with cylinders of the same size under the same throttling conditions. So this altitude engine is designed with cylinders large enough to bring the stresses on the working parts up to those on the normal engine at sea level conditions. In other words, the engine is built over-size.

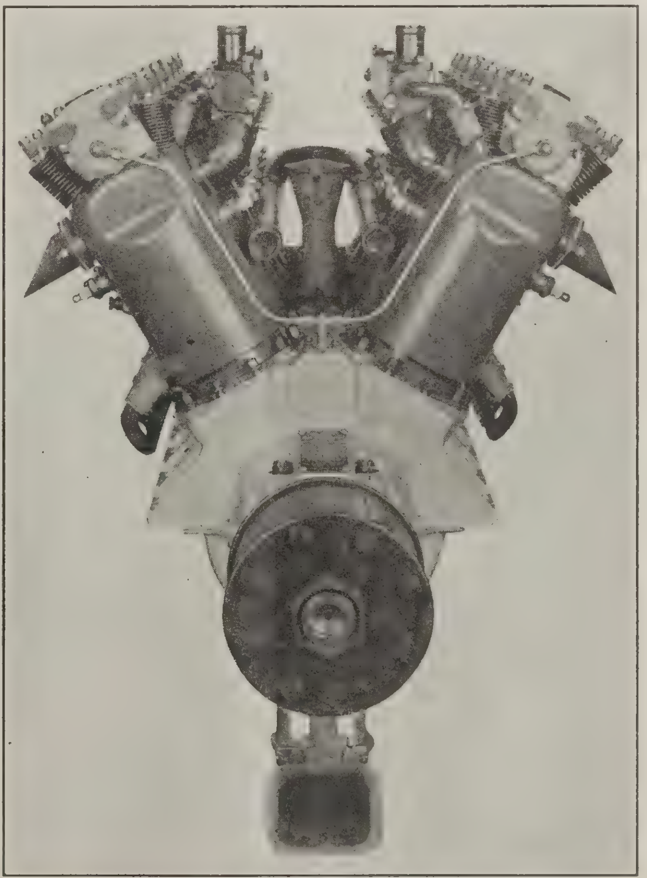
In designing this engine, the Packard Engineering Department took as a standard its "1116" engine, which was one of the most successful post-war aircraft power plants designed. It incorporated many valuable features learned from war experience, was extremely economical and reliable and was one of the smoothest aeroplane engines ever built, running with exceptional freedom from vibration up to speeds beyond 2,400 R.P.M. It was designed, however, on the usual basis of sea level conditions and showed the usual decrease in efficiency at higher altitudes.

In order to give this engine altitude efficiency, it was decided to retain all the main mechanical features of the design but to increase the compression to a ratio of 6—½ to 1 and make the cylinders ¼ inch larger in diameter. This raised the cylinder displacement to 1,237 cubic inches, from which the engine takes its name. When the first tests of this engine were made, it was feared that the oversize features would make it unwise to use full throttle at sea level since the increased stresses might be more than the engine could stand. The engine, of course, was supplied with a safety stop on the throttle which was not intended to be thrown off until an altitude of at least 5,000 feet had been reached, at which point the throttle could be opened wide.

The first dynamometer run of the engine, however, under the safety stop, gave such good results that it was decided to attempt a wide open throttle run. The results were extremely gratifying and the engine showed itself capable under these conditions of speeds in excess of 2,400 R.P.M. Although

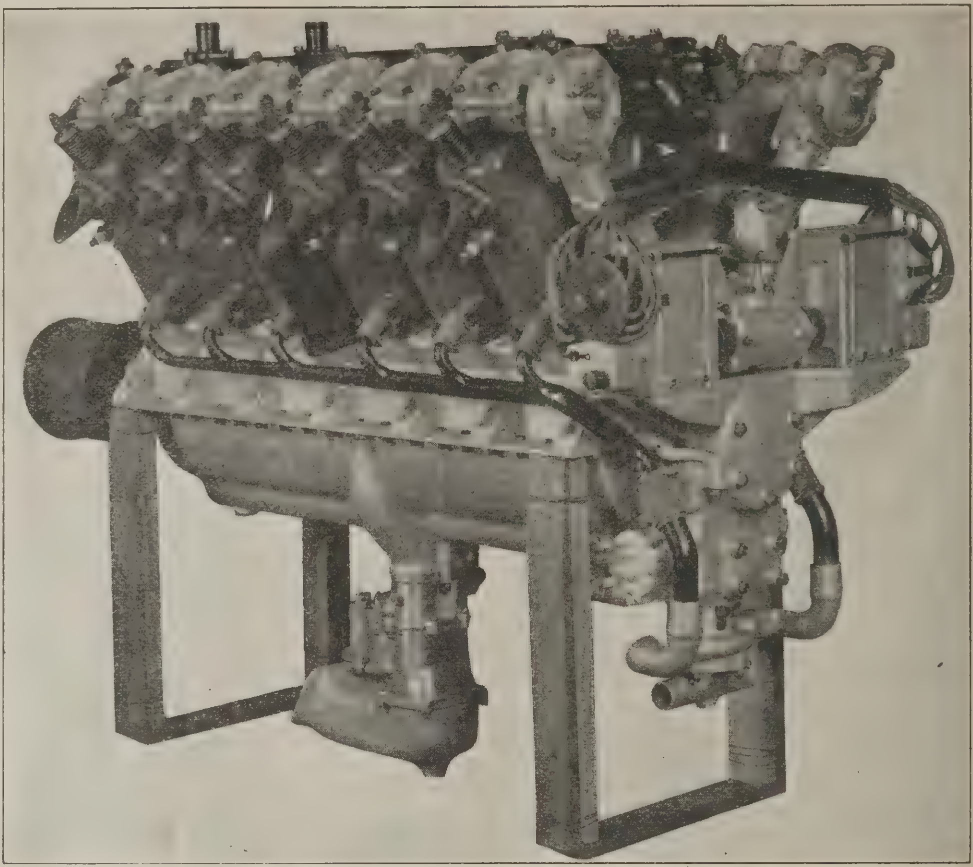


Magneto end Packard Model 1237 aero engine



Propeller end Packard Model 1237 aero engine

the engine was originally designed for only 300 H.P., a maximum of 400 H.P. was developed. This run was made on ordinary aviation gasoline and the engine did not suffer from either pre-ignition or detonation. This is in marked contrast to somewhat similar over-size engines constructed in Germany which cannot be run wide open near the ground except with "doped" fuels. It is not intended, of course, that the "1237" engine shall be run wide open near the ground for any long period, but it is extremely gratifying to know that this excess of power is available for taking off with a heavily loaded machine. It is expected that this engine will prove very popular for commercial use as well as for army and navy aircraft.



The Packard special altitude aero engine

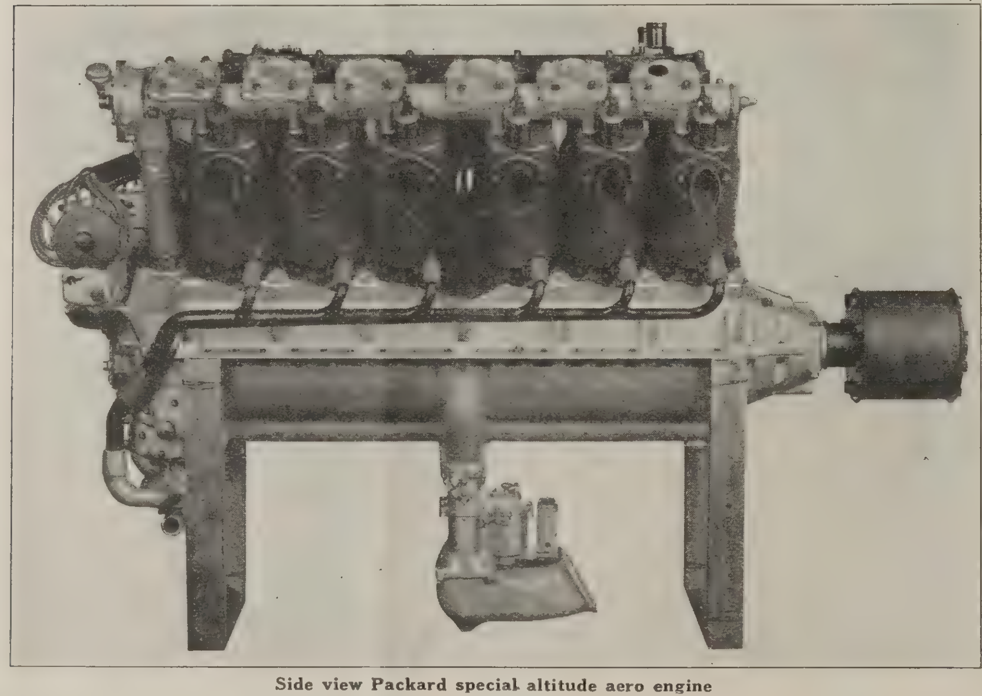
The maximum of 400 H.P. developed by this engine, it will be observed, gives it almost as much power as was possessed by the famous Liberty motor, which was more than 100 lbs. heavier. This has several clear advantages. In the first place, it becomes possible to run this engine for heavy duty at slow speeds and to take off comfortably with a heavily loaded plane, using the excess power for this purpose. In the second place, such an engine mounted in an extremely light speed plane can be expected to develop very high rates of speed. In the third place, the engines will have peculiarly interesting advantages at the higher altitudes. The high power it can develop in proportion to its weight at altitude makes it possible to expect speeds at altitudes considerably beyond any previous achievements with similar installations, and at the same time it should be possible to accomplish any given ceiling far more comfortably than with the earlier types of engines.

Such an egine as this should be very valuable in commercial use, in services such as that of the Post Office, where it is frequently necessary to rise to considerable heights in order to avoid storms and to maintain heights with heavy loads.

In its general design, the "1237" follows the lines of other Packard aircraft engines developed since the war and embodies the lessons learned during the struggle. It is of the Twin-Six type with the cylinder banks set at an included angle of 60°, with overhead valves, of course, and with an arrangement of accessories which has been worked out to give the greatest possible accessibility. The bore is 5 inches and the stroke 5¼ inches, and the actual displacement is 1237.005 cubic inches.

The crankshaft is of the now generally accepted type where a main bearing is provided on each side of each connecting rod and all bearings are carefully proportioned to give uniform life. The crank cheeks are of oval section, which gives the best combination of rigidity with minimum weight. The diameter of the main bearings is 2⅜ inches and the length of the bearings is as follows:

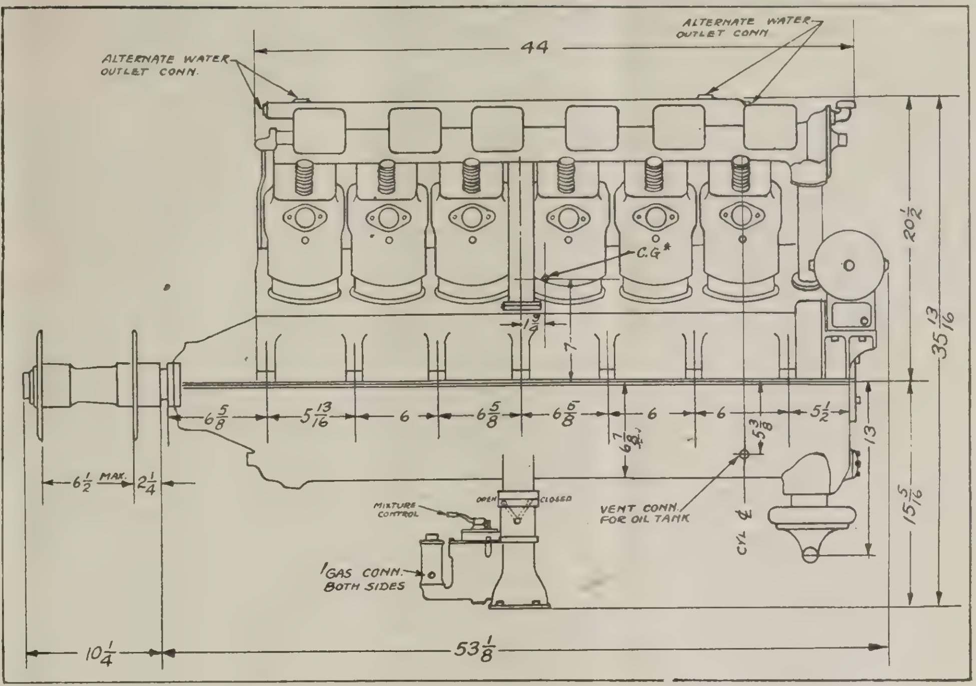
No. 1	1⅝ inches
Nos. 2, 3, 5 and 6	1¾ inches
No. 4	3 inches
No. 7	4.438 inches



Side view Packard special altitude aero engine

The connecting rods are of the straddle type suitably proportioned. The pistons are of aluminum alloy, die cast and equipped with floating piston rings. Three compression rings are fitted above the piston pin and one scraper ring below it. This scraper ring and its groove have proven in actual service to be extremely efficient in preventing excessive oil pumping. The standard compression ratio is 6½ to 1, but pistons giving a compression ratio of 5½ to 1 can be furnished for low altitude work. The propeller hub is of the detachable type carefully designed to prevent the propeller from either freezing on the shaft or becoming loose.

The crank case is of the box-section design, parted on the center line of the crankshaft with the main bearings carried between. Great rigidity is obtained by means of long through bolts which unite the two halves into a single rigid unit.



Side diagram special Packard altitude aero engine

The cylinders are of the individual steel type which is now generally recognized as being the lightest and most efficient type of design developed up-to-date. This type of cylinder gives the best possible water circulation and, therefore, the best valve cooling with the result that valve trouble is practically eliminated.

The valves are 2 inches in diameter in the clear with 30° seats, the intake valve lifted being 7/16 inch and the exhaust ⅜ inch. The camshaft and rocker arm assemblies are of the enclosed type developed by Packard and used so successfully in the Liberty engine. So far as we know, this is the most successful type of valve operating mechanism that has ever been developed for steel cylinder aircraft engines. A tachometer drive is provided on the end of each camshaft, permitting the installation of a tachometer in each of the two cockpits, if desired.

The lubricating system is full pressure feed, operating with a dry sump and it contains many improvements dictated by long experience. The oil pump and oil screens are readily accessible for examination and adjustment. A tapped boss is provided in the crank case to serve for the oil tank vent. The engine is designed especially for the use of a nose radiator, but is equally adaptable to any other type of radiator. The water-pump is located under the rear end of the engine and the water outlet connections can be carried to four different directions, depending on the installation requirements, without any change in the standard engine. A tapped boss is provided for the insertion of a standard distant type thermometer to register the outlet water temperature.

The engine is equipped with a single duplex Packard Zenith carburetor of the single Venturi type and is located before the engine. In addition to making it very accessible, this provides for gravity feed. It also insures the greatest possible protection from fire, all vents being carried outside of the cowling so as to eliminate any possibility of fire from back fire. The use of a single float chamber for a multiple cylinder engine has been found to give the best results from the standpoint of uniform distribution and maximum economy. The single carburetor was something of an experiment, but the difficulty of cynchronizing two or four carburetors for throttle as well as altitude control was so great that it was decided to make the attempt, since it, of course, obviates these difficulties. Data which tests have given us in regard to power output, gasoline economy and inlet manifold depression, show a very satisfactory result, and I think it extremely doubtful whether two or four carburetors could have given as good results.

The location of the carburetor in addition to its greater accessibility and safety from fire hazard is also a great advance from the point of view of installation and maintenance. The gravity feed simplifies the whole system and the change is one which certainly should commend itself at once to the

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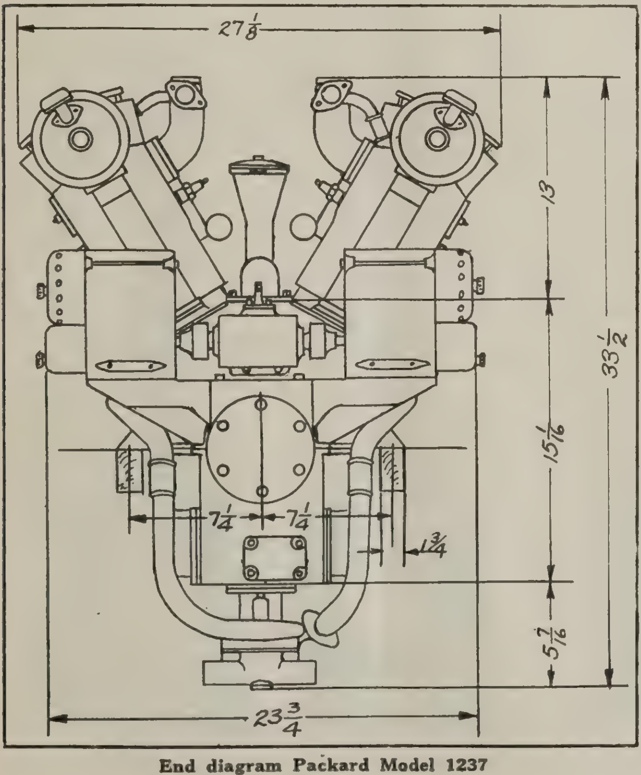
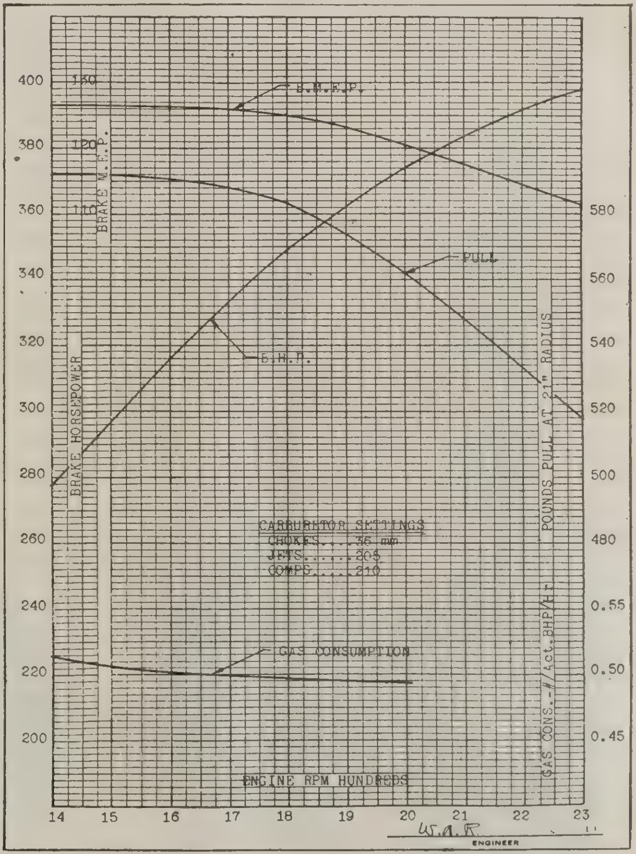


End diagram Packard Model 1237



Power curve and engine chart of Model 1237 wide open throttle

DESIGN OF STANDARD LUGS

By B. C. BOULTON, B.Sc.

THE purpose of this report is to summarize the work that has been done to determine the correct design for standard lugs.

In August, 1918, a report, S.T. No. 31-A, was issued describing the results of tests on what were known as U.S.D. 9 Standard Lugs. These were the usual type of concentric lug. Three specimens of each five lug sizes with capacities from 1100 to 4600 lbs. were tested. From the results of this test, the following conclusions were drawn:

1. "The actual strength of these lugs are not at all consistent with their ratings. With the use of 55,000 lbs. per sq. in. steel, the 1900 lb. lug is below its rating; the 2400 lb. lug has an actual strength of about 2480 lbs.; while the 3800 lb. lug is far stronger than its rating, having an actual strength of about 5200 lbs."
2. "It is to be noted, however, that the given ratings do not conform to the list of 19-wire cable or streamline tie rod ratings, but in general to the ratings of round tie rods, with several exceptions. It seems that the best plan for permanent lug standards is to make the ratings conform to cable ratings. Round or streamline tie rods could then easily be made interchangeable with cables by having about the same ratings and actual capacities, and by having all clevis dimensions agree."
3. "Since cable strengths are regularly 15 per cent over the ratings, the desired lug strengths should be at least 15 per cent in excess."
4. "The pin size should be chosen in conjunction with the lug thickness so that the maximum bearing stress shall not be more than twice the tensile strength of the material."
5. "The diameter of the head should be made sufficiently large so that the computed stress in direct tension in the section through the eye shall, at the maximum desired capacity, not exceed 80 per cent of the tensile strength of the material." Since in this test, as well as in subsequent ones, one of the chief questions for investigation was the apparently excessive bearing stresses, part of the discussion on this point is included. "It is to be noted that every failure in the first three types of lugs (1100, 1600 and 2100 lb.) occurred in the eye of the lug. The failure resulted from a combination of tension and shear with signs of incipient bearing failure evident by slight bulging of the metal under the pin. This bearing failure, however, was too slight to be objectionable in any of the lugs tested. By comparing the bearing stress with the tensile stress of the same lug it is seen that the bearing stress exceeds the tensile by nearly 100 per cent in most cases, and in a few instances is slightly more than 100 per cent in excess. Since an examination of the broken specimens discloses no excessive bearing failures, it therefore seems that a 100 per cent excess in this respect is a safe maximum for aeroplane lug design."

In the summer of 1919 the Materials Section of McCook Field began the study of lug design. A report, Serial No. 986, dated August 28, 1919, gives the results of the preliminary investigation of the subject. Tests were made on the 1100 lb. lug size only, but both .25 per cent carbon and 3½ per cent nickel steels, each in a dead annealed, cold rolled, and heat treated condition, were used for the specimens. Part of these speciments were of the usual concentric design; the rest were offset, some 1/32 in, and some 1/16 in. Three photographs showing typical failures with these two types of lugs are shown in Figs. 1, 2, and 3. A portion of the discussion in this report is given here. "The lugs with concentric radius were pulled to the elastic limit, yield point, and a few pounds below the ultimate strength of the material and examined under the microscope in order to determine at what point failure began. Fig. 2 is a good illustration of the failure of the lug just before the final break occurred. Measurements on several lugs indicate that the line of fracture comes at an angle of 45° with a diameter through the center of the original pin hole. Fig. 1 shows typical fractures for concentric lugs. Fig. 3 shows typical fracture for offset lugs."

"Microphotographs indicate that there is practically no failure in compression on the bearing area up to a point where the failure due to combined shear and tension at an angle of 45° is well marked and a considerable elongation of the grains has taken place."

"The slight piling up of the material above the pin seems to be due to a contraction of the eye of the lug due to this combined failure and is not a primary compression failure, as the grains of the metal are practically unstressed."

"The lugs with the offset were also tested and examined and it was found that by increasing the area through the section of the lug at an angle of 45° to the axis of the pin hole, it was possible to develop the full strength of the metal in tension at the point where the tension area is least, that is, on the section through the center of the pin hole on the horizontal axis."

The conclusions of this report are as follows:

1. By suitably offsetting the radius of the outside of a lug, the full tensile strength of the material may be developed

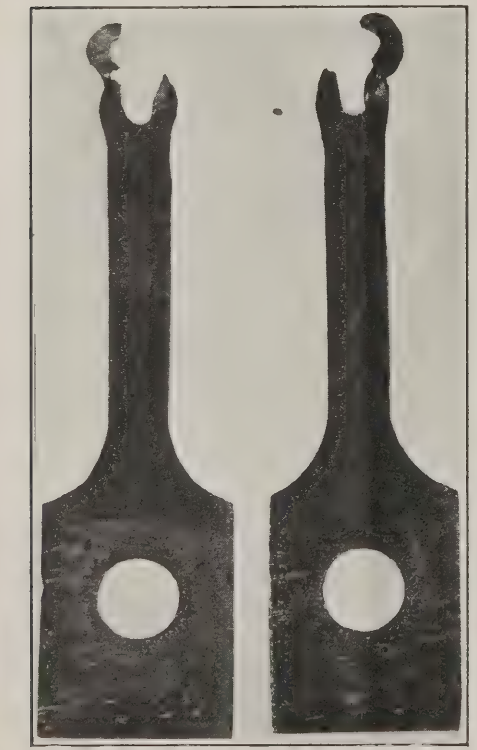


Fig. Typical Fracture for concentric lug

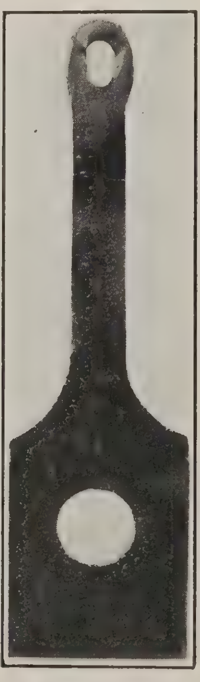


Fig. 2. Lug just before final failure

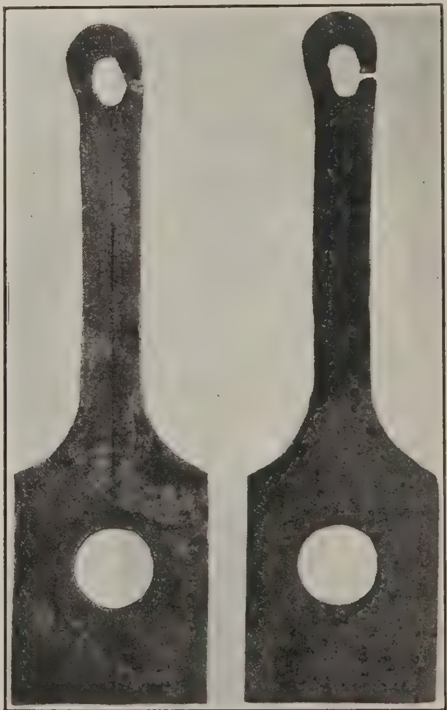


Fig. 3. Typical fracture for offset lug

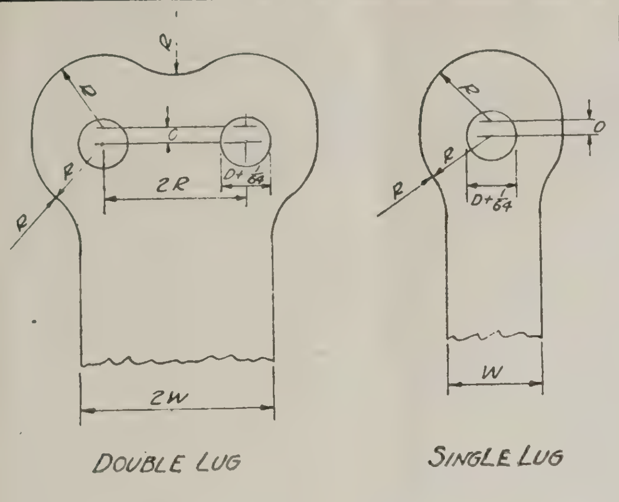


Fig. 7

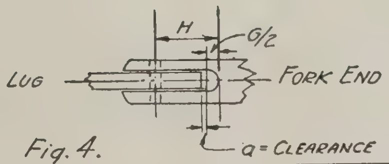


Fig. 4.

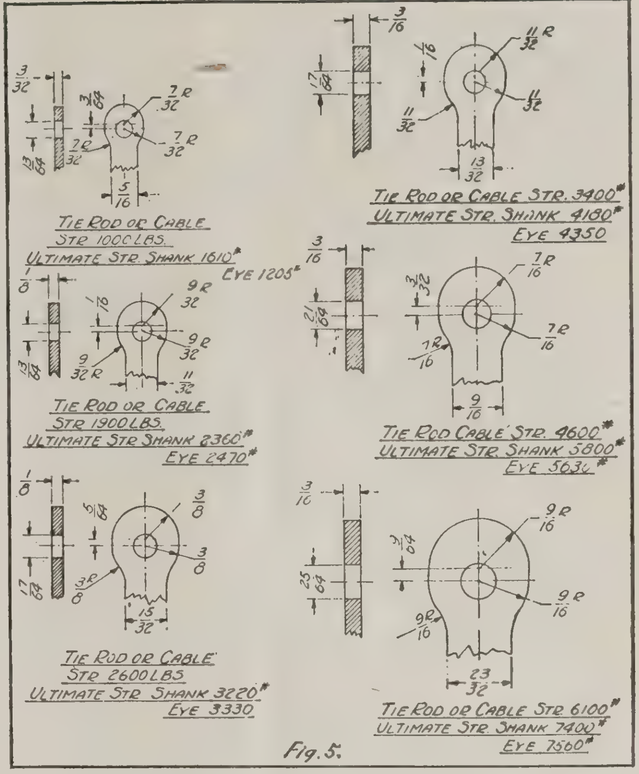

TIE ROD OR CABLE STR 1000 LBS.
ULTIMATE STR. SHANK 1610#
EYE 1205#
TIE ROD OR CABLE STR. 3400#
ULTIMATE STR. SHANK 4180#
EYE 4350
TIE ROD OR CABLE STR 1900 LBS.
ULTIMATE STR SHANK 2360#
EYE 2470#
TIE ROD CABLE STR. 4600#
ULTIMATE STR. SHANK 5800#
EYE 5630#
TIE ROD OR CABLE STR 2600 LBS
ULTIMATE STR SHANK 3220#
EYE 3330
TIE ROD OR CABLE STR 6100#
ULTIMATE STR. SHANK 7400#
EYE 7560#

Fig. 5.

TABLE 1

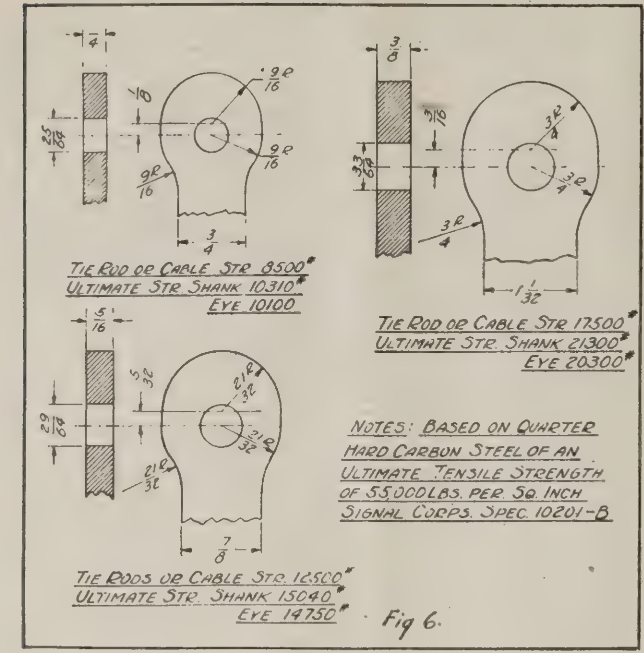
RATING		SHANK					EYE					PIN					
Tie-Rod or Cable	Col. 1 plus 15%	Gage	Width	Area	Strength	Strength Rated Ld.	Radius of Head	Net Area	Offset	Strength	Strength Rated Ld.	Diam.	Bearing Area	Bearing Stress	Area Pin	Shear Stress	% Area Increase due to Offset
1	2	3	4	5	*6	7	8	9	10	*11	12	‡13	14	—15	16	—17	†18
1000	1150	3/32	5/16	.0293	1610	1.610	7/32	.0220	3/64	1205	1.205	3/16	.0176	65300	.0276	20800	40.1
1900	2185	1/8	11/32	.0430	2360	1.241	9/32	.0449	1/16	2470	1.300	3/16	.0234	93400	.0276	39600	34.9
2600	2990	1/8	15/32	.0586	3220	1.239	3/8	.0605	5/64	3330	1.281	1/4	.0312	95700	.0490	30500	29.6
3400	3910	3/16	13,32	.0761	4180	1 230	11/32	.0791	1/16	4350	1.280	1/4	.0468	83500	.0490	39900	29.6
4600	5290	3/16	9/16	.1054	5800	1.260	7/16	.1024	3/32	5630	1.224	5/16	.0585	90500	.0767	34500	34.3
6100	7020	3/16	23/32	.1348	7400	1.213	9/16	.1376	9/64	7560	1.240	3/8	.0703	99900	.1104	31800	38 3
8500	9770	1/4	3/4	.1675	10310	1.214	9/16	.1838	1/8	10100	1.188	3/8	.0937	98200	.1104	41700	34.0
12500	14370	5/16	7/8	.2735	15040	1.203	21/32	.2685	5/32	14750	1.180	7/16	.1367	105200	.1501	47800	36.3
17500	20100	3/8	1-1/32	.387	21300	1.215	3/4	.369	3/16	20300	1.160	1/2	.1875	107200	.1964	51200	38.3

*Based on quarter hard carbon steel of an ultimate strength of 55,000 lbs. per sq. in. (Signal Corps Specification No. 10261-B).
†This increase in area is on a section through the axis of the lug.
‡Diameter of hole in eye equals pin diameter plus 1/64 in.
—Based on load in Col. 2.

TABLE 2

PROPERTIES OF MATERIAL						PROPERTIES OF LUGS					
Rated Lead	Elastic Limit	Yield Point	Ultimate Tensile Strength	Elongation in 2 in.	Elongation in 4 in.	Initial Failure in Compr.	Yield Point	Ultimate Strength	Bearing Stress	Yield Point	Ultimate Strength
Lbs.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Per Cent	Per Cent	lbs.	lbs.	lbs.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.
1	2	3	4	5	6	*7	†8	9	10	11	12
1000	....	47400	67700	6	6	....	1100	1520	....	45000	62100
1000	....	55000	68000	14	11	....	....	1475	....	....	59400
1000	....	49600	68200	9.5	7	....	1100	1400	....	44000	56000
1900	26000	34600	49700	39	28	1210	1325	2240	51700	27300	46200
1900	26000	36100	49000	40	26.7	1210	1455	2080	51700	30000	42800
1900	27000	36300	49800	40.5	28.7	1280	....	2018	54900	....	41700
2600	30500	34900	48500	43	32.2	1610	1825	2920	51600	29000	45600
2600	29000	36200	48700	43.5	34	1530	1830	2930	49000	28600	45800
2600	28000	35300	48700	47	35.8	....	1765	2960	....	27600	46300
3400	39000	45600	66600	27	21	3000	3680	5200	64000	46800	66200
3400	39000	45800	65700	35	27	3100	3900	4800	66200	49600	61000
4600	40000	43800	68200	32.8	23.4	3900	4500	6150	66700	46800	64000
4600	40000	43500	62000	35	28.1	....	....	6520	....	....	67700
4600	40000	45000	64600	32	25	4000	4500	6320	66600	46800	65700
6100	40000	47200	67800	32.5	32.8	5060	5630	6880	72000	46300	56800
6100	40500	45800	65700	....	....	5160	5570	7320	73300	46100	60500
6100	39500	45400	67300	35	27.5	5100	5600	7200	72600	46300	59500
8000	32000	39200	54000	37.5	27.3	7200	7600	9800	76800	42700	54300
8000	.....	39400	54500	39.5	30.8	7150	8000	9680	76300	44300	53800
8000	31000	40000	53600	35	26.5	7200	8000	9550	76800	44300	53000

*Initial failure in compression is taken as the point at which the pin hole in the lug elongates 5 per cent as measured between prick punch marks just above and below the hole.
†The yield point is taken as the point at which the pin hole elongates 10 per cent.


1/4
1/8
25/64
9R/16
9R/16
9R/16
3/4
TIE ROD OR CABLE STR 8500#
ULTIMATE STR. SHANK 10310#
EYE 10100
3/8
3/16
33/64
3R/4
3R/4
3R/4
1 1/32
TIE ROD OR CABLE STR 17500#
ULTIMATE STR. SHANK 21300#
EYE 20300#
5/16
5/32
29/64
21R/32
21R/32
21R/32
7/8
TIE RODS OR CABLE STR. 12500#
ULTIMATE STR. SHANK 15040#
EYE 14750#

NOTES: BASED ON QUARTER HARD CARBON STEEL OF AN ULTIMATE TENSILE STRENGTH OF 55,000 LBS. PER SQ. INCH SIGNAL CORPS. SPEC. 10201-B

Fig 6.

on a section through the pin hole perpendicular to the lug axis, and if failure occurs in the eye it will be at this section.

2. The form of eye for dead annealed, cold rolled and heat treated, either carbon or alloy steel, is the same.

From the results of this test a complete series of lugs was designed. The amount of the offset required could not be directly determined and so was estimated by making the area outside the pin on a section along the axis of the lug from 25 to 35 per cent greater than in the concentric design. The larger lugs required the greater excess area since the portion of the stress around the eye due to bending increases at something less than the square of the pin diameter. Below the 4600 lbs. size these lugs were designed for round or streamline tie rods because cable of a capacity less than 4600 lbs. is but little used. For all other sizes it was intended that the lugs should be designed for cables. They could then be used with all round or streamline tie rods except in the 8500 lb. capacity. In the final design the 8000 lb. lug was changed to an 8500 lb. lug so that in the entire series the lugs can be used with either cables, or round and streamline tie rods. To make this possible necessitated somewhat heavier lugs than would be required if the lugs could have been designed for one set of capacities only. The discrepancies between the capacities of the cables and swaged wires are sometimes rather large, but it is practically impossible, for manufacturing reasons, to make the capacities the same. In all cases the head of the lug was designed to have a strength at least 15 per cent in excess of the rated lug strength. Owing to the fact that the lug shank is usually bent, this part of the lug was given a minimum excess of strength of 20 per cent. Table 1 gives the actual, theoretical excesses in strength based on steel of an ultimate tensile strength of 55,000 lbs. per sq. in. In col. 15 of this Table is given the bearing stress for a load 15 per cent in excess of the lug capacity. In the worst case, for the lug of 17,500 lb. capacity, the stress for the normal load reduces to 93,200 lbs. per sq. in. which is not at all excessive. In col. 17 of Table 1 is given the shear stress on the pin. The value of this stress tends to increase for the larger sizes. As a considerable portion of the total stress in a pin is produced by bending, and as the section modulus of the pin increases as the cube of the diameter, the higher shear stresses in the larger sizes are not at all serious.

In Table 2 are given the test data for this series of lugs. By comparing the breaking strengths of the material as shown in col. 4, with the strengths developed on the section through the eye, given in col. 12, it is seen that in most cases the offset is just sufficient. In lugs of capacities, 1000, 1900, 2700 and 6100 the offset was increased by 1/64 in. In Table 1 the revised offsets are given, and these will be sufficient in all cases to develop the full strength of the material on a section through the center of the pin hole. The comments by the Materials Section on the lugs tested are as follows: "The results of the tests indicate that the design of the lugs is satisfactory as there was no pronounced crushing of the material above the pin, and practically all the lugs failed in tension on a section through the center of the eye. Compression failure is a combined crushing of the material and a closing in of the sides of the pin hole due at the bending moment on the sections of the lug either side of the hole. The results indicate that as the material increased in thickness the bearing stress per sq. in. can be increased. This is probably due to the increased stiffness of the heavier lugs on account of the mass of material which would lessen the tendency for the lug to close in on the sides of the pin." It is interesting to note, in connection with the design of lugs as given in the report, the properties of British standard lugs which are given in Table 3, especially the values of the offsets. It will be noted that for corresponding sizes the British lugs are offset about .02 to .03 in. more than was found necessary from tests at McCook Field. Another interesting feature of the British lug is the use of two equal offsets. No tests made here brought out the necessity for an offset back of the pin.

With the new standard lugs there are several changes that will have to be made. Because the rating of the lug which originally had a capacity of 2100 lbs. was raised to 2600 lbs. it became necessary to change the pin diameter from 3/16 in. to ¼ in. in order to avoid very excessive bearing and shear stresses. The universal fork end for the 1900 lb. lug will have to be altered to accommodate material of ⅛ in. gage instead of 3/32 in. This sized turnbuckle and plain fork end are correct at present in this respect. Table 4 shows the clearances between the ends of the lugs and the turnbuckles and fork ends as indicated by "a" in Fig. 4. There should be a 1/32 in. clearance. In all cases where a clearance is negative, and some cases where the clearance though positive is very small, the design of the turnbuckle or fork end must be changed. In all, seven such changes are necessary.

In Figs. 5 and 6 each lug in the series is drawn full size.

TABLE 4
CLEARANCES FOR TURNBUCKLES AND FORK ENDS

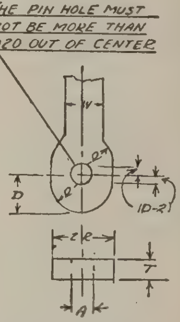
					Clearances		
		Fork Ends				Fork Ends	
Lug Capacity	Turn-buckles *H—G/2	Plain *H—G/2	Univ'rsal *H—G/2	R+O 1/64	Turn-buckles	Plain	Universal
1000	.394	.320	.290	.250	.144	.070	.040
1900	.425	.394	.415	.328	.097	.066	.087
2600	.425	.425	.430	.438	—.013	—.013	—.008
3400	.523	.523	.523	.390	.133	.133	.133
4600	.523	.648	.648	.515	.008	.133	.133
6100	.648	.648	.648	.688	—.040	—.040	—.040
8500	.742	.742	.648	.672	.070	.070	—.024
12500	....	.828	.820	.797	....	.031	.023
17500	....	.984	.984	.922	....	.062	.062

*See Fig. 4.

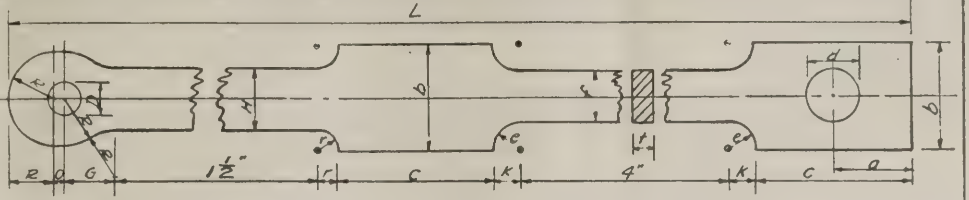
TABLE 3 - PROPERTIES OF BRITISH LUGS

SIZE	STRENGTH	T ±.004		A +.004 -.000	D -.000 +.02	R -.000 +.01	D-R	W -.000 +.02
		MIN	MAX.					
4BA	1050 LBS	.081	.096	5/32	.23	.20	.03	.30
2BA	1900 "	.114	146	3/16	.31	.25	.06	35
1/4 BSP	3450 "	.176	.196	1/4	40	.31	.09	40
9/32 "	4650 "	.182	.196	9/32	.50	38	.12	.50
5/16 "	5700 "	192	246	11/32	.57	44	.13	.55
11/32 "	7150 "	.242	.246	11/32	.57	.44	13	.55
3/8 "	8500 "	.266	.296	13/32	.65	.50	15	.60.
13/32 "	10250 "	.263	336	7/16	.73	56	.17	.68
7/16 "	11800 "	.282	.356	15/32	.78	.60	.18	.72
15/32 "	13800 "	310	.376	1/2	.83	.63	.20	77
1/2 "	15500 "	.323	.396	17/32	.88	.67	.21	.82

THE PIN HOLE MUST NOT BE MORE THAN .020 OUT OF CENTER



THE MINIMUM VALUE OF T IS FOR MATERIAL OF 26 TONS PER SQ.IN. IN TENSION. FOR OTHER MATERIAL T COULD BE PROPORTIONAL. BUT THIS IS NOT RECOMMENDED.



STANDARD LUGS FOR TEST

TABLE - 5

Rated Load	a	b	c	d	K	e	f	t	G	H	D	R	O	r	L
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1000	3/4	1	1 1/2	1/2	1/4	1/4	1/2	3/32	7/32	5/16	13/64	7/32	1/32	11/32	12 5/16
1900	3/4	1	1 1/2	1/2	1/4	1/4	1/2	1/8	5/16	3/8	13/64	9/32	3/64	5/16	12 7/16
2600	3/4	1	1 1/2	1/2	1/4	1/4	1/2	1/8	3/8	17/32	17/64	3/8	1/16	1/4	12 9/16
3400	3/4	1	1 1/2	1/2	1/4	1/4	1/2	3/16	3/8	15/32	17/64	11/32	1/16	9/32	12 9/16
4600	3/4	1	1 1/2	1/2	1/4	1/4	1/2	3/16	15/32	19/32	21/64	7/16	3/32	7/32	12 23/32
6100	3/4	1	1 1/2	1/2	1/4	1/4	1/2	3/16	19/32	25/32	25/64	9/16	1/8	1/8	12 29/32
8000	1	1 3/4	1 7/8	3/4	21/32	1	3/4	1/4	9/16	23/32	25/64	17/32	1/8	17/32	14 13/16
12500	1 1/4	2 3/16	2 3/8	15/16	13/16	1 1/4	15/16	5/16	23/32	29/32	29/64	21/32	5/32	21/32	16 9/16

A D.M.-

From these figures may be obtained an idea of the proportions of the lugs.

Fig. 7 shows a double and single lug with the same dimensions denoted by the same letters. It will be seen that double lugs may be drawn up from the dimensions given in Table 1 for single lugs. In all cases the distance, 2R, between pin centers is sufficient to provide clearance with two turnbuckles or folk ends.

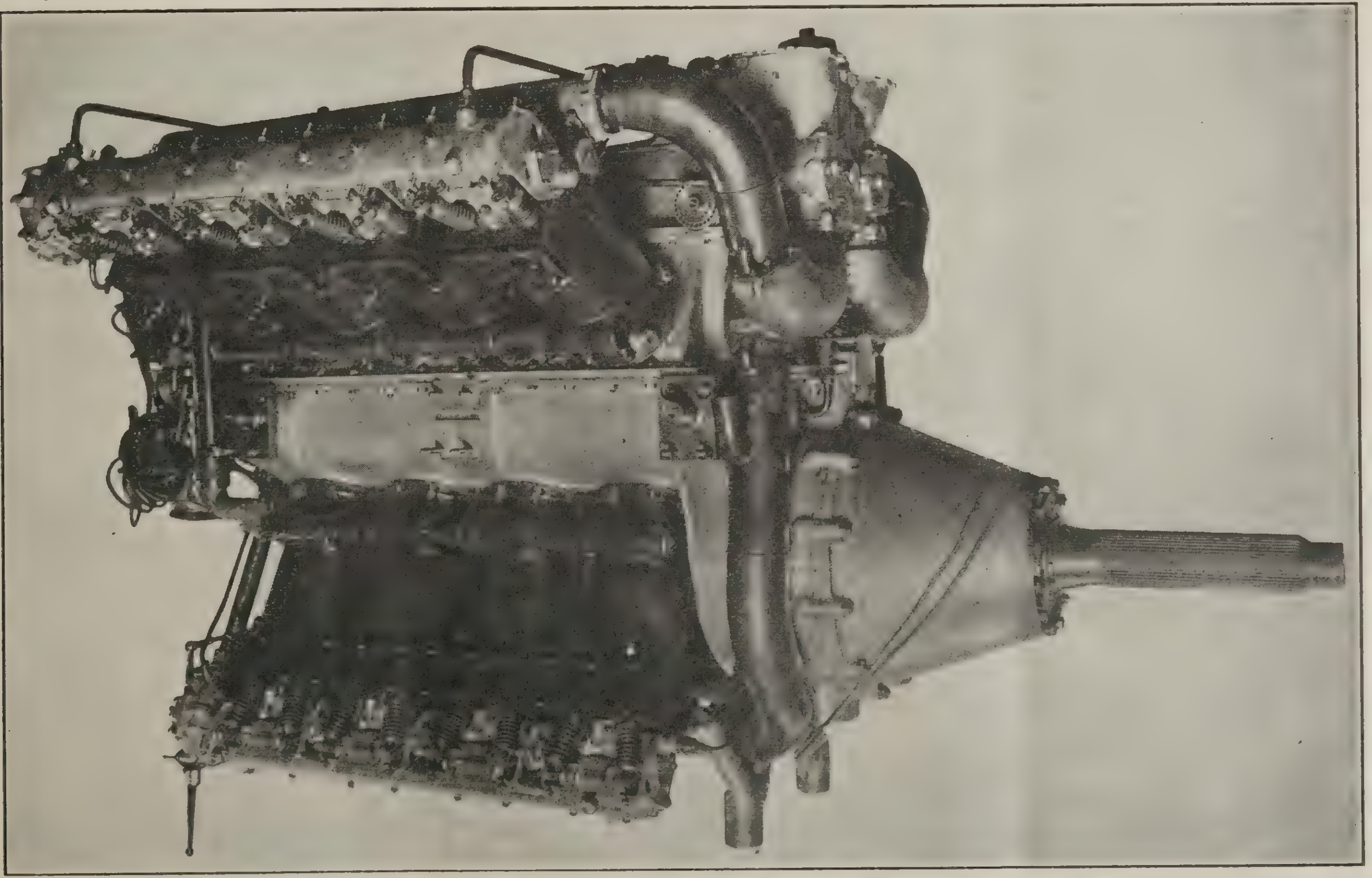
In conclusion one more point may be taken up. An objection to the use of soft steel lugs, of the sizes recommended in this report, is that, once their yield point is passed, they elongate a considerable amount before failure occurs, while the tie-rods with which they may be used show practically no elongation until very close to their ultimate strength. Ordinarily it is not considered good practice to have a large distortion in a fitting before distortion occurs in the main members. The answer to this is that the yield point of the lug is about 65 per cent of the ultimate strength, and in no circumstances will an actual air load equal to 65 per cent of the ultimate strength of the structure be imposed upon it. Therefore, in service the lugs will never be stressed beyond their yield point and hence will not elongate. The margin between the yield point and the ultimate strength is purely a margin of safety.

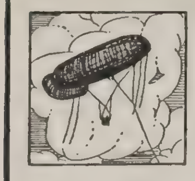
THE NAPIER 1000 H. P. AERO ENGINE

AS we have reported in AERIAL AGE, D. Napier & Sons, Ltd., of England, have recently developed and tested a 1,000 H.P. aero engine.

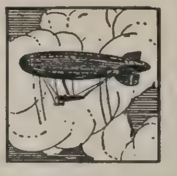
This engine—the Napier "Cub"—has been built for the British Air Ministry, and in its first bench test has given very satisfactory results. The engine gives great promise, and will undoubtedly revolutionize aviation. Before any steps can be

(*Continued on page* 643)





FOREIGN TECHNICAL DIGEST



Organization of Air Routes

In the *Bulletin de la Navigation Aerienne* for December, 1920, and January, 1921, there are comprehensive articles dealing with the aerial routes already established in England, Switzerland, France, Germany, Belgium, Spain, Holland and Denmark. Diagrams are given of all of the important airports and they constitute an interesting feature for any community or organization contemplating the layout of a landing field. (*Bulletin de la Navigation Aerienne,* December, 1920, and January, 1921, 25 pages, 10 diagrams.)

A Comparison of the Cost of Transport and Ton-Miles by Land, Sea and Air

This paper was presented before the British Royal Aeronautical Society by Lord Montagu of Beaulieu, and dealing with air transportation he states:

In regard to the cost of conveyance by aircraft, I have been in communication with some of the firms who have been conducting recently regular commercial services by aeroplane and find that their statistics vary a good deal. Lately, at the Air Conference at the Guildhall, Mr. White Smith, whose opinions are entitled to much weight, stated that a machine could be flown between London and Paris at about 38d. per aeroplane mile. The D.H.18 has lifted and flown with a weight of 2,200 lb., but with a D.H.18 designed purely for goods carrying, and at the reduced speed of 75 miles an hour, the machine would lift probably as much as 2½ tons, or well over 5,500 lb., and the cost per ton-mile would therefore be correspondingly reduced. This figure of 38d. has recently been thought too low, and later and perhaps safer calculations place the cost at about 40d. per machine-mile. It is clear that in this case there can be no competition with other older methods of conveying heavy goods in bulk. But with passengers, mails and valuable and special freight the outlook is promising. I am inclined myself to think that the cost of aeroplane transport at the present moment is in the neighborhood of 44d. per ton-mile, if a reasonable profit is to be included and all risks provided for. At this price the aeroplane can only compete successfully with existing transport because of its speed either over land or sea. As I have said before, speed is a quality which the public are willing to pay for, and speed is the commodity which sellers of air transport will find most saleable.

We now come to airships. In the case of the airship of the large type, which recently flew from Great Britain to America and back, the cost was ascertained to be in the neighborhood of 23s. 6d. a mile flown. To take the concrete case of England to Cairo and India, and allowing 50 hours for the journey to Cairo and 50 hours on, the expenditure comes out according to Air Commodore E. Maitland, at the following figures:

	Per mile over land or sea s.	d.
Interest on capital expenditure.........	7	0
Cost of operating the airships...........	23	5
Cost of running the bases	11	0
	41	5

Or an "all in" cost of 497d. per mile made good over the ground. If the airship could carry, as a conservative figure, 15 tons of commercial load for a journey occupying 50 hours, this would make the "all in" cost per ton-mile 35½d. for such a journey—not a formidable figure in comparison with other methods of fast transport.

Allowing seven passengers to the ton, which for practical purposes amounts to each passenger being allowed 1 cwt. of luggage free, and one ton of mails at 6d. per oz. for each stage of 50 hours, the following table is of interest:

England to	Airship Approximate Time of Transit days	Airship Mails (1 ton carried) oz.	Airship Passengers	Steamer Approximate 1st Class Steamer Passenger Fare	
Egypt	2¼	6d.	£ 50	£ 45 to £ 50	Now increased about 20% beyond these figures.
India	5	1s.	£100	£ 65 to £ 70	
South Africa	6½	1s. 3d.	£120	£70	
Australia	10½	2s.	£190	£115 to £128	

The above figures are based on airships actually under construction (R.38 class); showing a profit of 15 per cent., and are based on the carriage of 75 per cent. of the possible passengers.

The passenger ton-mileage in this case would work out at about 34d., but no doubt these costs will be reduced later on. And while the cost is nn this case moderate, there would be a great saving in time on a non stop run for at least 2,500 miles—say, London to Egypt, or 3,800 miles—London to India.

	Land		
From station to station.			
Per train—Passengers, 15 to ton at 3rd class fare of 2d. a mile	3od.	B	
Goods, aver. (1910)	1.6d.	B	
From origin to destination.			
Per motor lorry—goods in not less than 3-ton lots..	7d.	B	
Per bus or char-a-banc—15 passengers to ton	22½d.	B	
Per aver. motor car	7d.	A	
Per motor cycle...	2d.	A	
	Sea		
From port to port.			
Mail ship	.066d. to .072d.	A	Calculated on gross weight of steamer & contents.
Passenger ship (intermediate)	.050d. to .058d.	A	
Cargo liners	.038d.	A	
	Air		
From aerodrome to aerodrome.			
Aeroplanes for mails and passengers, D.H.18	30d.	B	
Aeroplanes for goods, D.H.18 (special type) ..	14d.	B	Estimated
Airships for mails and passengers, say, 10 tons in all	36d.	A	
Airships for goods (R.38)	35½d.	A	Excluding insurance
Aeroplane, 2-engine Vimy type	126d. per machine mile	B	

A—weight of vehicle included.
B—weight of vehicle not included.

	Average speed in m.p.h.
1. Aeroplane for mails and passengers..	100
2. Aeroplane for goods	80
3. Airships for mails and passengers..	60
4. Airship for goods	50
5. Express and fast trains...........	40
6. Ordinary passenger trains	25
7. Motor-cars and motor-cycles	20*
8. Mail or fast passenger ship	16
9. Motor bus or char-a-banc..........	15*
10. Average goods train..............	14
11. Motor lorry for goods.............	13*
12. Ordinary passenger ship...........	12
13. Ordinary cargo ship...............	10

*The road motor vehicle is the only vehicle which can collect and deliver without intermediate handling between origin and destination.

(*Aeronautics*, January 27, 1921, 4 pages.)

International Aeronautical Maps

This paper was presented before the Royal Geographical Society of Great Britain by Lieut.-Col. E. F. W. Lees, D.S.O.

In the International Air Agreement it is laid down that there shall be two series of international air maps: one series, to be known as General Aeronautical Maps, is to be on Mercator's Projection, on a scale of 3 cm. to 1 degree of longitude at the equator—*i.e.,* a scale of about 1:3,700,000 at the equator, a longitudinal scale of about 1:2,000,000 in our latitudes. Certain criticisms have been levelled at the adoption of Mercator's Projection; these will be referred to later.

The second series, to be known as Local Aeronautical Maps, is to consist of degree sheets on a scale of 1:200,000; no particular projection is laid down, nor is this necessary. In many countries maps exist already on a scale of 1:200,000, and no doubt these maps will be utilized; it must be remembered, however, that in their existing forms they satisfy only imperfectly the needs of the airman.

The annex lays down also:—

(i.) That the index scheme for the Aeronautical Maps shall be based on the index scheme for the International 1 million map.

(ii.) That the metre shall be the standard of length.

(iii) That the colours and symbols of the 1 million series shall be used as far as possible: it will be seen that considerable departures from this proposal are suggested.

(iv.) That, in addition to the customary latitude and longitude notations, the maps shall bear numbers in enclosed rectangles corresponding to a new system of co-ordinate reckoning based on the South Pole and the antimeridian of Greenwich: that is to say, the latitudes commence with the South Pole as zero, and increase northwards to 180° at the North Pole, and the longitudes commence with the present 180° as zero and run eastwards round the sphere to 359°. By this system the employment of the letters N. and S. and E. and W. is avoided, and an index number can be given to any sheet based on the co-ordinates of its south-west corner. It should be noted that under this system of indexing certain general and local maps will bear the same index number, and that it will therefore be necessary to employ the prefix general or local when demanding aeronautical maps.

(v.) That each sheet is to be given a suitable geographical name.

The work involved is immense, and a considerable proportion falls on the shoulders of the British Empire. The Air Ministry were faced with the problem of compiling and producing these maps, with no existing machinery. The problem was solved by an arrangement between the War Office and the Air Ministry, whereby the Geographical Section of the General Staff should undertake the work. (*Aeronautics,* January 20, 1921, 2 pages.)

NAVAL and MILITARY AERONAUTICS

Two New "Blimps" for North Island

Two additional "blimps" will be in commission on North Island within a short time, the ships in question being the B-3 and the C-4, single and twin-motored, respectively.

The new B-3 will be essentially similar to the B-18, now in commisison. A new envelope has been received for this dirigible, to which a car formerly used by the B-18 will be attached. Thus a practically new "blimp" will be added to the North Island lighter-than-air squadron.

The engines, car and control surfaces of the Navy dirigible C-4 arrived at the station on the U. S. S. *Nero* a few days ago. It is understood that a new envelope will be forwarded by the Bureau of Construction and Repair when available.

The engines of the C-4 are two in number, and of the Hispano-Suiza 150-h.p. type, driving the big gas bag at an air speed of from 60 to 65 miles per hour. This dirigible has already seen considerable service at the Naval Air Station, Rockaway Beach, N. Y., the old envelope having been recently surveyed.

The C-4 is a sister ship to the C-6, which came to grief at Hollywood last fall.

Fine Service from Old Dirigible Obtained By North Island Personnel

A notable exemplification of what care can do in relation to the prolonging of the "life" of blimps is the case of the Navy Blimp B-18, which came to San Diego station from Cape May, N. J., last May.

Since that time the blimp, which had seen a great amount of service prior to its arrival, has been in the air 315 hours, or an average of nearly one and one-half hours per day. The recent flight of the lighter-than-air craft off Point Loma was a creditable ending to a long and arduous record of service.

Officers and men who had charge of the blimp are being congratulated on the long service obtained from a mechanism which was already well worn upon its arrival at this station.

Daniels Urges U. S. Own All Wireless Stations

Ownership of all radio stations in the United States in order that government monopoly of the air may result was recommended to the Senate by Secretary Daniels in a letter to Senator Page, chairman of the Senate Committee on Naval Affairs.

Secretary Daniels's opinion was sought by Senator Page on the Senate bill providing for the regulation of operation and the development of radio communication in the United States.

Secretary Daniels said that before the entrance of the United States in the war, higher power radio stations within the United States "had been constantly engaged in the transmission of unneutral messages" and added: "It is unnecessary for me to point out to you the consequences which might flow from such practice." The Naval Secretary points out that cable and radio interests might combine and form a monopoly.

"Should such a combination of interests exist, I need not tell you that the interests of the public would suffer," the Secretary said. "With the government in control of radio as a competitor of the cables there would be every assurance that cable rates would be just and reasonable and we should also have every reason to believe that competition would be secure in the supply of important radio material, which would not be the case if companies now engaged in the manufacture of material should become interested in the joint ownership and operation of radio stations."

Naval Appropriations

As it passed the House February 14th the Naval Appropriation Bill carries a little more than $7,000,000 for naval aviation. No provision whatever is made for new construction in this branch, although naval experts emphasized before the House committees the necessity for progress if aviation is to be made effective.

Secretary Daniels said he would make every effort to have the Senate Naval Committee make at least reasonable provisions for aviation.

"We did not ask for an excessive appropriation for aviation and to be cut off without any provision for new development is a very serious matter," he declared.

Naval aviation suffered in the House primarily because of the friction between the enlarged Committee on Appropriations and the standing Committee on Naval Affairs.

Mather Field Aerial Paths

Aerial paths to all national forests in California, Oregon, Washington, Montana, Idaho, Nevada and Utah will radiate from Mather Field during the coming forest fire season.

Five aerial patrols will be on duty constantly during the fire season, with reserve aviators on call at Mather Field. It is a theory of the army that forest patrol work is excellent training for aviators and close co-operation between the war department and the department of agriculture which controls the forests, has been decided upon.

Five air squadrons and 1,000 men will be stationed at Mather Field. The field, it is believed, soon will be the largest air service training station in the western department of the army.

A forest rangers' school, intended to bring better co-operation with the army aviators, is being conducted at the field. To the same end, a meeting of the forest supervisors of California, with representatives from several western states and from Washington, D. C., will be held Monday.

Improvements to care for the added personnel at the air field are expected to consist of twenty-four sets of permanent quarters.

Pursuit Training at Kelly Field

Cross-country formations of from 3 to 5 planes have been scheduled and carried out during the past week. Many of these formations have been sent as far as 75 miles and in all cases the formation returned intact. Target practice has been scheduled for nearly each afternoon, but so far the range has not been available because of lack of repairs to the dugout. The 147th Squadron leads the Group for flying time this month with the 94th Squadron following a close second. The 27th Squadron and the 95th Squadron are having a race by themselves with the betting a little in favor of the 95th. During the period from January 1 to January 20, 1921, the 147th Squadron has piled up a total of 313 flights, with time in the air of 170 hours. The 94th Squadron also has its hat-in-the-ring with 125 hours time, the 95th and 27th Squadrons have 91 and 89 hours respectively. It looks as though the Kicking Mule and Flying Eagle would have to instill a little "pep" into their movements or let their old rivals hopelessly outclass them. Early morning fogs have prevented a full week of Battalion drill, but it is hoped there will be a different story to tell next week.

Extension of Dewey Decimal Classification Applied to Radio

A year ago the radio laboratory of the Bureau of Standards prepared a tentative scheme of classification of radio subjects. This has now been revised as an extension of the Dewey Decimal System and is useful in classifying radio references, drawings, books, and reports. The whole subject of radio communication is put in its proper place in the Dewey Classification—621,384—but it is suggested that these figures be abbreviated to the use of the letter R, in a purely radio library. An abbreviated classification is provided for the use of small libraries or collections. An alphabetical index enables one to refer readily to the classification number of any subject desired.

The main headings into which the subject of radio is divided are as follows:

R000	Radio Communication
R100	Radio Principles
R200	Radio Measurements and Standardization
R300	Radio Apparatus and Equipment
R400	Radio Communication System
R500	Application of Radio
R600	Radio Stations — Operation and Management
R700	Radio Manufacturing
R800	(Vacant or to be used for non-radio subject matter)
R900	Miscellaneous Radio

It is desired to make this classification as complete, comprehensive, and usable as possible, and the Bureau of Standards will be glad to send a copy of the complete classification to any persons interested, so as to place it in the hands of those having use for it and also with a view to possible future revision.

Personal Par

Captain W. I. Rasor has been assigned to Carlstrom Field.

FOREIGN NEWS

Foch on the German Air Menace

Speaking on the disarming of Germany on Monday, at the Conference of Allied Premiers in Paris, Marshal Foch stated: "The German air menace is deadlier than ever in its potential means of destruction."

Federation Aeronautique Internationale

The meeting of the Bureau of the Federation Aeronautique Internationale was held in Paris on Monday, January 10th, 1921.

Prince Roland Bonaparte was in the chair, and representatives from the following countries were present: America, Belgium, France, Great Britain, Holland, Italy, Sweden, Switzerland.

Lloyd's and the Air

A number of underwriters, members of the Committee of Lloyd's', officials, and other friends, were present at a dinner recently given in London by Mr. Sidney Boulton (Chairman of Lloyd's).

In the course of an appreciative reference to the work of Sir Frederick Sykes (Controller General of Civil Aviation), Mr. Boulton said that when the question of compiling an aviation record was brought forward, Lloyd's offered its services, and, the offer having been accepted, established an aviation record which they hoped would in time equal in importance the register of Lloyd's Register of Shipping. Possibly at some future time the Shipping Register would be in a museum and the aviation record would have taken its place.

Major-General Sir Frederick Sykes said the co-operation of Lloyd's was one of the greatest factors they were able to obtain in the building up of an aerial commercial transport service. It would have been impossible to build up an Air Force on a fighting basis only. What was needed was a great reserve, and the only way to obtain that was to establish a commercial air transport service. Lloyd's had helped in innumerable ways, and had taken the lead in insurance in regard to aircraft in England, as against other countries.

Melbourne—Brisbane

Mr. C. J. Degaris, a Melbourne business man, who on November 30th, last year, flew from Melbourne to Perth, a distance of 2,169 miles, on a DH-9, left Melbourne, as passenger on a DH-4, on January 9th, and arrived at Brisbane on the following day. Three landings were made *en route,* the actual flying time for the distance of 1,100 miles being 10½ hours.

London-Berlin Air Service

It was reported in the *Times* that in the spring a regular air service will run between London and Amsterdam, with connections to Hamburg, Copenhagen and Berlin, and by means of the smaller German interior air lines, to all the principal German cities. The route to Copenhagen will be extended by a seaplane service to connect with Sweeden.

It is said that the Fokker F-2, 6-passenger enclosed cabin monoplane, fitted with the 240-h.p. Siddeley "Puma," will be used, a number of which are now being built at the Fokker works at Amsterdam.

Zeppelin Works Active

According to the German technical Press, the Zeppelin factories are being kept in running order as far as possible. The Friedrichshafen works are engaged on the making of automobile engines and spare parts, and are now working in double shifts with order sufficient to keep them going for a considerable time.

Accurate Landing

The French aviator, Fronval, has established a world record for landing at a given spot when he ascended to a height of 1,000 metres and came down within nine feet of the spot indicated. The actual measurement was 2.60 metres. Fronval holds the record for looping-the-loop.

Toulouse-Barcelona-Casablanca

The importance of the bi-weekly air service between Toulouse-Barcelona-Casablanca Alicante-Malaga-Tanger-Rabat-Casablanca, started by M. Latécoère in 1919, is shown by the fact that from September, 1919, to September, 1920, 454,686 kilometres were covered and 1,065 passengers carried without a single accident.

Aero Club of Holland Interested in Aerial Touring

With a view to speeding up the development of civil aviation in Holland, the Royal Aero Club of Holland has appointed a committee for Aerial Touring. Among the items which are put down for its consideration are: Modifications of the International Aeronautical Convention to facilitate aerial touring; study of the best machines for touring; competitions; development of aerial routes; research work on signals, etc.; simplification of customs formalities; means for popularizing aerial touring.

International Competitions in Norway

It is reported that aeronautical enthusiasts in Norway are organizing an international competition for aeroplanes, to be held during the Northern Sports Week, which takes place some time this month. It is anticipated that there will be some entries from Finland with machines specially designed for landing on snow or ice.

University of Strasbourg

It is reported that the study of aerodynamics has been included in the curriculum of the University of Strasbourg and that diplomas will be granted to those students passing the course of studies which have been scheduled.

Aero Club of Chile and the F. A. I.

It was recently agreed that the Aero Club of Chile be temporarily affiliated with the Federation Aeronautique Internationale.

L'Aéro Club de Belique

On December 18th, last, the Aero Club of Belgium celebrated the twentieth anniversary of its foundation.

Two Vickers-Vimy Seaplanes for Canada

The Canada Steamships Lines have purchased in England two Vickers-Vimy seaplanes capable of carrying 12 passengers each for an aerial service between Montreal, New York and Toronto—to be started next summer.

Peking-Shanghai Air Mail Service

The Chinese Government has sanctioned the inauguration of an air service between Peking and Shanghai, with three intermediate stations and 80 landing grounds. It is hoped that after carrying the mails for six months a public service will have been secured which will carry both passenger and goods traffic. From Peking to Shanghai is 700 miles.

Prome Aerodrome, Burma

The Burma Government, in view of the projected air service between Calcutta and Rangoon, has decided on the immediate construction of an emergency aerodrome in Prome, about 160 miles north of Rangoon. The site selected by the Royal Air Corps is the former Prome race course, about two miles south of the town, and measuring approximately a square of about 600 yards. It is now overgrown with jungle, which the Department of Public Works is engaged in clearing. It is expected that the new aerodrome will be completed by March.

French Enterprise

L'Air, the well-known French aeronautical journal, has just published a special issue reviewing the French Aircraft Industry. M. Flandin, formerly Under-Secretary for Air, has contributed a preface which, in part, reads:

"Why should not the Aeronautical Industry obtain a great deal of business? In 1835 no one had foreseen the enormous extension the railway would take. Is it so unreasonable to predict that aerial transport will become as important?

"But if this must take place, I am of the opinion that French aviation is well placed to hold one of the best positions in the world. Nobody will dispute the services rendered by the French savants and engineers; everybody knows the progress that has been accomplished by our manufacturers with regard to construction. Also everybody remembers that French aeronautical firms have sold quite a lot of cellules and engines to our friends and Allies during the War. Those are beautiful titles and splendid testimonials to bring forward. I feel confident that the future of French aviation will not be inferior to the tradition and to the examples of its glorious past.

"Already a few training schools have been established abroad, they were created, managed and directed by several of our compatriots, and prove to be efficient. Military missions have already spread in Brazil, Peru, Japan, the fame of our machines. A few French lines of aerial naviagtion are already working over different countries and which are good for propaganda in Spain, Tcheco-Slovaquie, Poland; they make our industry favorably known in those countries. These are happy and profitable enterprises; let us go ahead in that way.

"Nature has generously placed our country at the cross-roads of all the important European and even Mondial routes. This is an unequalled position as regards the facility of traveling abroad. Richelieu has been able to write: 'It seems that nature has been waiting to present France with the Empire of the Seas, so well are her coasts situated and equally provided with excellent harbors both on the ocean and on the Mediterranean.' Let us transpose this right happy remark, and it will apply to the Aerial Dominion. France must unite the Old World to the Continents, which constitute the stores of humanity, by her aerial lines; those aerial lines in their turn, will support her Aeronautical Industry; and this industry will need no better reference, on the foreign markets, than the progress realized in France by aerial transport."

Japan to Study Flying

Three aviation officers, namely Capt. Oseki of the Aviation School; Lieut. Hiraga of the Balloon Corps, and one Lieutenant, whose name is not yet published, will be despatched abroad early this year, reports the Tokio *Asahi,* for the purpose of studying the various kinds and possibilities of gas and also manufacture of aeroplane engines.

Capt. Oseki will be sent to France and Lieut. Hiraga to Germany, while the other Lieutenant will go to England. They will stay abroad for three years, during which period they will act as Government agents for the purchase of flying machines.

Argentine Army Air Service

The following information has been received in a letter from Buenos Aires, Argentina, from a former Lieutenant in the U. S. Army Air Service under date of December 30, 1920.

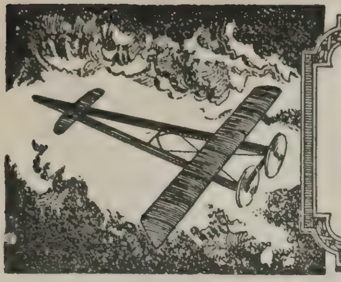
"Palomar is the Army flying field situated about ten miles southwest of Buenos Aires. It compares in size and contour with the field at Aberdeen, Md. During a day of races, recently held at Palomar by the Argentine Army Air Service, the Curtiss Company was invited to participate. The first exhibition was a formation of eight Caudrons which, with one Nieuport, one Spad and four Avros, approximately completes the equipment of the Argentine Army Air Service. The Caudrons are manufactured in Buenos Aires primarily for training purposes. They are tractors with a nacelle for two passengers, dual control. Gnome and Le Rhone rotary and Anzani radial engines are used.

"After the formation a native pilot gave an exhibition of acrobatics in a Nieuport. Lieutenant Wilmot of a British aviation concern also gave a splendid exhibition of acrobatics in an SE-5. The next contest was a relay race of four teams, each team consisting of one Avro, one "Airco" (DH-6), one Curtiss and one Caudron. The afternoon's festivities ended with this relay race, as a heavy storm came up.

"It was the writer's opinion that the general public enthusiasm in aviation is confined a great deal to the spectacular. It was noticed that a number of the pilots were very mechanical in their movements and do not seem to fly as well as more experienced fiyers from other countries. This, however, is a matter of opinion.

"As to commercial aviation, the active commercial operations in or near Buenos Aires seem to be confined to two British concerns; the Handley Page Company and the Airco Company, known locally as the River Platte Aviation Company. In addition to these is the one North American concern, the Curtiss Aeroplane and Motor Company. There was, until recently, a French Company, which has gone out of business.

"The Handley Page Company has sold a number of Avros, including twelve to the Army and a number to civilians, in addition a few D.H.-4's and Bristols. There are a few Curtiss aeroplanes in private use. The younger ranch owners have learned to fly and use these planes for trips to town and wherever else time might be saved. It is not known just how many Curtiss planes are being used in the business of carrying passengers but it is estimated the number cannot be more than ten. Storms with high wind and hail are quite sudden and severe. The climate and seasons in the vicinity of Buenos Aires are generally good for flying and the flat surroundings afford many good landing fields."



ELEMENTARY AERONAUTICS *and* MODEL NOTES

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931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore. Md.

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Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

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AERO SCIENCE CLUB OF AMERICA
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1813 W. 7th St., Little Rock, Ark.

Equipping a Model for Winter Flying

MODEL fliers need not give up their experiments during the winter months, for there is a good deal of interest to be found in flying models which are provided with runners or other devices, permitting them to rise from the frozen surface of a lake or pond. The hard surface of ice is one of the best launching places for models, as the surface is level and is generally smooth, besides being of a nature which presents very little friction to the model skimming on the surface before taking the air.

Instead of the usual wheels, a land model may be equipped with curved skids or skiis. If it is desired to launch the model from snow, broad skiis may be used with good effect. Runners made of 1/16″ flat wire has been used considerably for the landing gears of the usual land machine and is very well adapted to the ice.

In flying a model close to the ground it will be observed that any unevenness of the earth's surface results in a corresponding disturbance in the air in that vicinity. For this very reason the air above the surface of the ice will usually be found to be free from sudden changes in the trend of the wind.

To get your machine to rise quickly it must be headed into the wind when starting. Experiments might also be made in launching at an angle to the wind to try the effect of directional fins, etc., and to observe their adaptability toward swerving the machine into or away from the wind. Launching the machine with the wind will be found to require a much longer run on the ice before the machine begins to sustain itself, but a longer flight will result from launching it by this method.

Another factor which lengthens the flight when a model is launched with the wind is the fact that the propellers are unwinding against the wind and the extra work required of them keeps the power stored for a longer period of time.

It is interesting to note that in many countries where snow and ice prevail many successful full-sized aeroplanes have used skiis or runners. Machines of this kind have been tried out in some parts of the United States, Canada, Switzerland, Russia and Germany, and no doubt other countries have found it to be thoroughly practical during the winter months.

Aeroplane Models Exhibited at Toy Show

Among the interesting exhibits at the Toy Show, being held at the Hotel Imperial, New York City, February 1 to March 12, 1921, is the line of toy aeroplanes, manufactured by the Broadfield Toy Company of Hempstead, New York. The exhibit includes model gliders and "looping" gliders, designed to operate even in a high wind. The flying model types shown are of the twin pusher type which have been tried out extensively in flight before being put into production.

Mr. Billings, who desgined these models, was well known some years ago as an expert model builder whose machines made many records at Van Cortlandt Park at about the time the Aero Science Club was organized.

A novel device brought out by this company is a launching arrangement consisting of a length of rubber elastic and two stakes for attaching to the ground. The idea of this device is to supply the model with sufficient initial momentum to insure a longer flight.

During the Toy Show the company has made special arrangements and issued invitations to buyers, merchants and manufacturers to witness outdoor demonstrations of their models at Van Cortlandt Park. These demonstrations are held at the Polo Field every Sunday during the Show at 10 o'clock in the morning and at 2:30 in the afternoon.

Model aeroplanes are also exhibited at the toy fair by the American Art Toy Company, the Mars Company and the Ideal Model Supply Company, of New York City; The Scott Toy Corporation of Newport, Vermont, the Scientific Products Co., Balto., Md., and Lawrence Airplane Model and Supply Company of Chicago, Ill.

Models Built by Aerial Age Readers

Mr. Paul Burroughs, of Center Falls, Rhode Island, recently completed a flying model of the De Haviland 4 with which he had good flying results. He is now engaged on the design of a Curtiss JN-4-D and expects to complete it soon.

A Model Hydroaeroplane

(*Continued from Feb. 14th issue*)

Pontoons

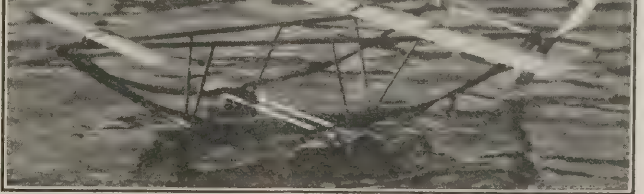
Main pontoon formed over a 2″ cardboard mailing tube to obtain the curved back. The veneer used is soaked in water and allowed to dry thoroughly over the tube, after which it is trimmed to the desired side outline. The veneer used is 15/1000 thick, or about 1/64″. Interior bulkheads or formers are of the same material. (Balsa might be used, hollowed out for lightness, though a heavier pontoon will probably result.)

Wing floats spaced with spruce members of ⅛″ round reed.

Wings

The front wing is of solid thin spruce, curved in a high camber. The main wing frame entirely of spruce, covered with transparent drawing paper attached with hot glue. Leading edges ⅛″ x 3/32″; trailing edge slightly thinner. Solid ribs 1/32″ thick are formed to the wing outline, drilled to admit the main dowel 3/32″ round. The raked wing tip, formed as shown in the sketch, makes the neat formation of the wing end a simple matter.

The covered wing has no finish other than two coats of Valspar varnish. The entire frame, pontoons, propellers and front wing are also finished with Valspar to prevent distortion due to warping.



The hydroaeroplane flying model described above, outline drawings of which appeared in Aerial Age last week

"Honey" Meant Aeroplane

A soldier who confessed to being from up-State, New York, sat down in a little café in the American zone and asked for honey to ease the deglutition of his war bread. He had always had honey at home, he explained to a comrade, who sat opposite, and he wanted it here. But the little waitress in wooden sabots and torn apron could not understand that strange word. The soldier scratched his head, and found an inspiration. He waved his hand slowly about his head: "Buzz, buzz, buzz," he said, thinking even a French girl must know that bees make honey.

"Ah, *oui, oui,*" said the waitress, her face lighting up, "aeroplane."

"No aeroplane," said the up-Stater indignantly; "here, I'll show you," and on a slip of paper he drew his conception of a bee.

"Ah, *oui, oui,*" again said the waitress, after scanning the drawing; *"j'ai dit,* aeroplane."

The soldier gave up.

Too Evident

Nervous Old Lady (*on small English air-'bus*): "Oh dear! How we're rocking! I'm sure an accident will happen to this machine!"

Elderly Aboriginal: "It's along o' their bein' short-handed wi' skilled men, mum, so my son's orfered to drive her just to oblige, and (*confidentially*) I don't think e' knows much about it."

Right!

"Explain the meaning of celerity," commanded the teacher.

"It's what you get out from under a falling aeroplane with," answered the young hopeful who had been reading aeronautical literature.

Speaking of Aeroplanes—

A friend once said, "this world is but a veil of tears, and we're the ships that sail thereon"; according to this belief it seems that an aviator is far better off than we humans who tread upon terra firma, for his position brings him above the veil of tears. But, after all, aviator, like every human, has his ups and downs, which is quite consoling to ourselves. It seems to us, however, that much of an aviator's troubles could be avoided if a little more judgment were exercised in the matter of providing for the unexpected. For instance, in the matter of motor trouble, very often brought about through faulty lubrication, improperly adjusted spark plugs, carbonized cylinders, etc., etc. To obviate the necessity of coming to earth in the case of trouble, it seems to us that an aviator might carry an extra motor, or in the least, several additional cylinders, so that in the event of trouble with the cylinder of a motor the faulty one might be replaced by a good one, and so on. In the case of lubrication, why trust to defective mechanism to lubricate when it would be just as easy to spray the entire motor with oil as a flower is sprayed with water, thereby insuring complete lubrication within and without. For the moment we cannot think of how easy it might be to adjust spark plugs while in flight, but some day when we have more time we will devote a little space to this question and show up the inefficiency of some of these sox experts. There is no need for all this inefficiency and defectiveness in connection with motors, no siree; and when we get more time we're going to look into the matter and set this problem right once and for all.

Built for Speed

"I was out over the speedway today, and in thirty seconds I did a mile in four laps."

"That's nothing. I know a young lady that did thirty miles in one lap, and she would have done more if I hadn't got a cramp in my knees."

Had to Do It

You can't surprise a Chinaman. An aeroplane was flying over Pekin for the first time and a proud European pointed it out to a native.

"Don't you think it is wonderful?"

"Well," said the Chinaman, calmly, after a passing glance at the machine, "the thing is meant to do that, isn't it?"

He Looked It

The nervous young flying officer sat down at a table in the vegetarian restaurant.

"Crushed nut, sir?" asked the waitress, handing him the menu of the day.

"No, no; shell shock," he replied.

Speed

The young R.N.A.S. officer turned to his fair companion and took her hand in his. "Molly," he pleaded, "will you marry me? Once more I ask."

But Molly shook her head. "No, Jack," she said, "for the twelfth time in an hour I tell you, I will not."

Jack rose to his feet—"Oh, well," he sighed, "after all, twelve knots an hour is not bad speed for a little bus like you."

Ground Flying

"What was my most thrilling experience?" mused the ex-pilot. "Ah! I could never forget it. It was a bright starlight night, but the lurid flashes around us obscured all else as we sped through the air. The advancing enemy was hard upon us, while all around we heard the weird, savage music so terribly familiar, and the thud as of a thousand falling meteors. We dived, looped, corkscrewed till our senses were numbed. I felt a sharp pain in my right foot, a dull weight in my side—I was falling, falling—and knew no more till I found myself lying on the ground badly smashed some hours later."

"And that was really your record aerial engagement?"

"No," he replied; "it was my first experiment with the jazz."

Free Verse

The dame stood by the roaring 'plane
Then clutched at wig and hat in vain.
"They're gone—he's gone. Alas no more
Have I my 'Air Comb-I-Adore."
"Not so," shrieked the wind that jammed her,
"That's not your Commodore. That's a wig commander."

The Wrong Motion

Smith: "What's the matter with Brown? Every time he sees an aeroplane he trembles and grows pale with fright."

Jones: "Oh, his wife eloped with an aviator."

Smith: "And when he sees a machine in the air the recollection causes him pain?"

Jones: "No, no—he is afraid it is bringing her back."

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ROLAND ROHLFS, Chief Test Pilot, Curtiss Aeroplane & Motor Corporation:—

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Information and price furnished on application.

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(*Continued from page* 633)

aeroplane engine designers.

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Standard ignition equipment consists of two 12-cylinder Dixie magnetos with fixed spark advance. A Vernier type magneto coupling permits the magnetos being properly set and synchronized in a minimum length of time. The magnetos are interchangeable, that is, they revolve in the same direction. Complete double ignition to two sets of spark plugs is provided and the engine will function properly on either set.

The standard engine has provisions for taking the following accessory equipment without any changes:

1. Rear end electric starter
2. Gasoline pump
3. Gun synchronizer drive
4. Generator drive.

The utmost pains have been taken in all ways to insure accessibility of the working parts and to permit ease of installation. As a result the engine is believed to be in these respects the most successful of any of its type yet built.

The total weight of the engine, dry, is 737 lbs., and on the maximum shown of 398 H.P. output, this gives a weight of 1.85 lbs. per H.P. The gasoline consumption with wide open throttle averages almost exactly ½ lb. of fuel per horsepower hour. The accompanying sheets give further details in regard to the performances of the engine on the dynamometer.

(*Continued from page* 637)

taken to make extended flights, the engine will, of course, go through very thorough trials both on the ground and in the air.

Although the experience gained in the construction of the 450 H.P. Napier "Lion" engine has ben of great value in designing this "Cub" engine. it is built on an entirely new principle. As will be seen from the photograph, it is comprised of four sets of 4 cylinders each—16 cylinders in all—X shape, not absolutely diagonally opposed, but with two top sets of cylinders at a smaller angle than the two lower sets.

From all points of view—reliability, speed and economy—to have one unit developing a high power is better than a number of units developing together the same power.

It is of interest to state that this engine was designed in the south of France, soon after the Armistice, under the supervision of Mr. M. S. Napier, who, for reasons of health, is compelled to reside there, the chief designer, Mr. A. J. Rowledge, and some of the drawing office staff going out there specially in connection with this important work.

The success of the Napier "Cub" opens up remarkable possibilites for aviation in general. The use of this engine in commercial aviation means greater economy will be obtained, thereby reducing the cost at which it is possible to carry passengers or luggage, with its consequent popularization of aviaton, and opening up a wider scope for air travel.

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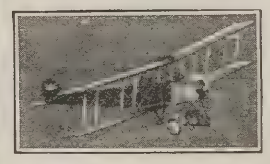

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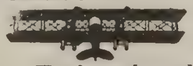

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AERIAL AGE
WEEKLY

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Airscape of Bryn Mawr College, photographed by Captain James Suydam

The Aerial Mail Achievement

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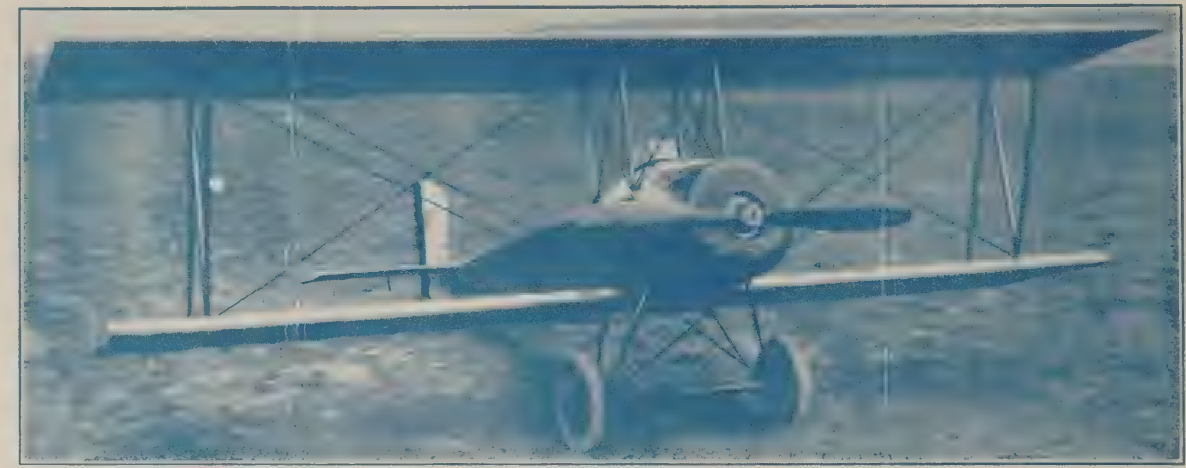
"The Marvel of the Air"



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AUTHORITY

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THE AERIAL MAIL ACHIEVEMENT

JUST how Congress will justify its lack of interest in the air mail after the spectacular trip from San Francisco to New York the average citizen may find it hard to predict. The thirty-three-hour record, the courage and efficiency with which the pilots carried on and the demonstrated practicability of night flying are proofs of the excellent morale and organization of the service and point to an extraordinary future usefulness. It should be remembered also that this test was made under weather conditions as unfavorable as are likely to be encountered.

Commenting on the achievement, the *New York Times* said:

"To the 'man in the street' the carrying of the mails from coast to coast in twenty-five hours and fifty-three minutes of actual flying time was a sporting event. His interest centers in the passage of the Sierra Nevada at an altitude of 12,000 feet and in the daring flight of a pilot with a broken nose in dark and storm between North Platte and Chicago, a feat without parallel in civil aviation. Aviation owes a great deal to Otto Praeger, Second Assistant Postmaster General, who has been indefatigable in establishing mail routes, whose work can be checked off in monthly reports showing cost of gas, oil, repairs, pilotage, mechanical help and overhead charges; but American aviation owes even more to the brave youngsters, some of them ex-service men, who have attempted what has often seemed to be the impossible in flying according to schedule in all weathers. There have been casualties, as in war, but science always claims its victims. Without risk and sacrifice, no progress. There are critics who think that the Post Office Department's air mail service is dangerous and costly, but nothing venture, nothing gain. The modern world demands efficiency and speed; aviation is international and competitive. To-day the United States has distanced all countries in transportation of mails through the air. Probably the most ambitious service in Europe is that between London, Paris, Strasbourg and Prague three times a week. It seems like a leisurely function compared with our divisional services between New York and San Francisco, taking in the chief cities. Mr. Praeger has now demonstrated that mail can be carried between the Pacific and Atlantic coasts and delivered in about thirty-three hours. Night flying is necessary to success, but when stations are provided with systems of flares, and when landing fields are vividly illuminated, flying by night will be safe enough."

"What was accomplished early in the week in carrying the mail between San Francisco and New York in less than a day and a half will soon be the regular order, for a schedule is to go into operation on May 1. San Francisco will be able to get the New York newspapers on the afternoon of the day after publication. It must always be considered that progress in civil aviation is of incalculable value to the army and navy."

In its comment the *New York Tribune* takes a look ahead:

"The achievement of the Air Mail Service in spanning the continent in thirty-three hours is a pioneer effort that forecasts the actualities of the future. The flight along the trail made famous by the Pony Express is the forerunner of a twelve-hour mail service between New York and San Francisco, even as the Pony Express was the forerunner of the iron steeds which reduced the mail time to four days.

"The record established is the beginning of a transcontinental service which will be accelerated from year to year, until it finally reaches a speed that will deliver mails in San Francisco twelve hours from New York. All air experts agree that this is no dream, but an actual possibility based upon known facts. At high altitudes aeroplanes can take advantage of the trade winds that blow at 200 miles an hour in the atmosphere between thirty thousand and fifty thousand feet above sea level.

"The feat completed Wednesday was by the very service which certain elements in Congress have just fought desperately to destroy. Can antagonism be continued against a service with such a record, and is there still blindness to the fact that it keeps in training young men who can be readily transferred to the defense of the nation and sustains the aircraft industry, one of the key industries in national defense,"

THE NEWS OF THE WEEK

Transcontinental Flight in 22½ Hours

Jacksonville, Fla.—Lieut. W. D. Coney, who started from Love Field, Dallas, Texas, at 10:14 Central time, February 23, on the last lap of his ocean-to-ocean flight, arrived at Camp Johnston near here at 7:25 o'clock next morning. The official time of Lieut. W. D. Coney's flight from San Diego, Cal., was 22 hours and 27 minutes. The official time between Dallas, Texas, and Jacksonville was 8 hours and 11 minutes.

To complete his trip from the Pacific to the Atlantic, Lieut. Coney passed over the city on his arrival and dipped down to touch the landing wheels of his plane on the beach. He then swooped up again and went to the landing field.

With the exception of two hours, the flight from Dallas to Jacksonville was made in darkness.

"Not until I was over Mobile, Ala., did I see a light," Coney said after his arrival. At times, he added, he made a speed of 150 miles an hour, but that the average speed for the trip was approximately 100 miles an hour.

As news of his arrival spread, crowds flocked to the landing field and scores of Brunswick relatives and friends overwhelmed the officer. His mother, Mrs. E. F. Coney, and three brothers were here to welcome him.

If official sanction can be obtained Lieut. Coney plans to make the return trip from Jacksonville to San Diego, Cal., by daylight with one stop at a Texas point for refueling.

Lieut. William D. Coney, Air Service, was born in Atlanta, Ga., on November 20, 1893. His education was received at the Georgia Institute of Technology.

The month after the United States engaged in the war—in May, 1917—Lieut. Coney entered the first Officers' Training Camp at Fort McPherson, Georgia, from which camp he was transferred to the Aviation Ground School at the Georgia Institute of Technology on July 10, 1917. On September 8th of the same year he was sent to Essington, Pa., where he received flying training. During the latter part of October, 1917, he was sent to Kelly Field, San Antonio, Texas, where, after graduating on January 8, 1918, he received a commission as second lieutenant in the Air Service of the United States Army. At Kelly Field he acted as flying instructor from the date of his graduation until October, 1918, when he received orders to proceed to a port of embarkation in New York preparatory to going overseas for active military duty. Due to the signing of the armistice, however, orders covering his sailing were revoked, and he was sent to Carlstrom Field, Arcadia, Fla., on December 22, 1918. Here he again acted as flying instructor, and was also a member of the Testing and Engineering Department at this field.

Ordered to Washington on May 15 1919, Lieut. Coney served as a member of the Information Group in the office of the Chief of Air Service until February 8, 1920. At this time he was sent to Mather Field, Sacramento, Cal., where he was assigned to the Ninety-first Aero Squadron, of which he has been a valuable officer up to the present time.

Lieut. Coney has rendered efficient service on duty with a detachment of the Ninety-first Squadron in the southern part of the State in connection with the aerial border patrol operating between United States and Mexico. He further proved his value to the Air Service by accomplishing exceptionally fine work during the past season as an aerial forest fire patrol pilot operating out of Medford, Oregon.

Third Annual Aviators' Ball

The Aviators' Ball will be held this year at the Waldorf-Astoria on Thursday, April 7, 1921. Owing to the unprecedented success of the ball, both in 1919 and 1920, the capacity of the Ritz-Carlton was greatly overtaxed and the entire second floor of the Waldorf has been engaged this year, making the same reservations as are used by the time-honored Charity Ball, which allows half as much more dancing space for the coming ball.

Army Aviators Prepare to Bomb Warships

Army aviators who hope to uphold the contention of Brig. Gen. Mitchell that aircraft has virtually made battleships obsolete are to receive a special course of instruction of about a month in anticipation of the tests against battleships.

Army orders directed four army aviators to proceed to the army proving ground at Aberdeen for the special instruction. They are Second Lieuts. W. S. Fitzpatrick, G. C. McDonald, H. F. Rouse and W. B. Souza. What the course will consist of was not disclosed. Rules under which the tests will be made are being considered by the joint Army and Navy Board.

The former German battleship Ostfriesland will probably be the first target, and will be bombed from the air by both army and navy flyers about 150 miles out at sea. Later it is expected the obsolete battleship Iowa, fitted with radio control apparatus, will be used as a target while actually under way at sea at a speed of about ten knots.

2 Plane Carriers Favored for Navy

Washington.—An army of an average strength of 175,000 for the next fiscal year was provided in appropriations approved recently by the Senate Sub-Committee on Military Affairs in completing its report on the Army Appropriation Bill for presentation to the full committee. This strength compares with an average of 150,000, as provided for in the bill as passed by the House.

Lieut. W. D. Coney who flew from the Pacific to the Atlantic Coast in twenty-two and a half hours

The bill as reported by the Senate Sub-Committee, provides $7,800,000 for aviation, compared with $4,000,000 favored by the House. Of this increase, $3,000,000 would be used in purchasing new planes and equipment. An increase also was made for vocational training, the total being $2,500,000, as compared with $1,000,000 adopted by the House.

Construction of two fast aeroplane carriers for the Navy at a cost of $48,000,000 each would be authorized under an amendment to the Naval Appropriation Bill adopted recently by a Senate Naval Sub-Committee. Fifteen million dollars would be made available next year for starting work on the craft which have been recommended by naval experts.

The sub-committee also doubled the House appropriation of $6,000,000 for naval aircraft procurement and left untouched the $90,000,000 appropriation for continuing work on the 1916 building programme, including eleven super-dreadnoughts and six battle cruisers.

Appropriations also were voted for the new naval bases on the Pacific Coast. These include $1,500,000 for Alameda, $1,000,000 for Los Angeles and $800,000 for San Point, Wash.

Aero Club Enterprise

Announcement of a $500,000 transaction in Long Island real estate has been made by Daniel W. Blumenthal, of the law firm of Maurice B. and Daniel W. Blumenthal, counsel to Joseph H. Wichert, of Brooklyn. The 152-acre Wichert estate, at Mattituck Inlet, between Port Jefferson and Greenport, has been transferred to the newly formed Old Mill Haven Yacht and Aero Club.

On the property, it is stated, will be established the first aerial yacht club to be organized in America. The site is ideally situated, both for yachting and pleasure flying, being in the heart of the Long Island summer colony, adjacent to South Hampton, East Hampton, Sag Harbor and Shelter Island.

Applicants for membership are being considered by the club's provisional board of governors, which includes Commodore Francis Mayer, of the New York Yacht Club, and Brigadier General William Mitchell, of the Army Air Service. The club's executive secretary is Major William G. Schauffler, of Lynbrook, L. I., and New York City, late of the Army Air Service, and a member of the Aero Club of America.

It is expected the club will commence work shortly on the clearing and levelling of a forty-acre flying field, the erection of hangars, and the construction of sheds for flying boats.

A large house at the head of the inlet, overlooking the Sound, will be renovated and furnished as quarters for the club's members, and numerous houses on the estate will be prepared as week-end lodges and bungalows. The club's plans also include the eventual laying of an eighteen-hole golf course.

The Army Air Service already intimated to the directors a desire to assist in the construction of the airdrome and is considering a proposal to locate a practice squadron on the Old Mill Haven field this summer.

In addition to furnishing facilities for private pleasure aircraft, the club proposes to maintain a fleet of passenger planes for the use of its members generally. Nearby residents, whose business calls them frequently to New York during the vacation season, will be afforded an opportunity to fly to and from their summer homes to their offices. Aerial pleasure cruises will be a feature of the club's activities.

For yachtsmen the club offers the only safe haven on the north shore between Port Jefferson and Greenport. When dredging operations in Mattituck Inlet are completed this spring, craft of seven-foot draft will be able to sail into the club anchorage at low tide.

The club expects its doors will be open to members by June 1.

22,000 Foot Jump Made from Airship to Earth

Fort Sill, Ark.—What is believed by aerial officers here to be a world's altitude record for a parachute jump was established recently, when Sergeant Ensel Chambers, 135th Aero Squadron, jumped from an airship piloted by Lieutenant Wagner at a height of 22,000 feet during an aerial circus at Post Field.

The previous record is said to be 20,900 feet. Chambers landed six miles from his take-off.

Neta Snook to Tour Orient

Miss Neta Snook, who has been operating a field near Los Angeles for the past four months, will leave early in March for the Orient and will spend six months in China and Japan with Barr's Flying Circus. She will pilot a ship for plane changing and stunting.

On February 22nd Miss Snook took part in the race organized by the Aero Club of Southern California.

Personal Par

William D. Grant, formerly Captain in the Army Air Service, has been appointed General Manager of the Christiana Machine Company, Christiana, Pa.

Civil Service Appointments

The Civil Service Commission of Washington, D. C., announces open competitive examinations for the Federal Civil Service for various grades of aeronautical draftsmen to fill vacancies in the Langley Memorial Aeronautical Laboratories at Langley Field, Hampton, Va. The salaries range from $1,200 a year to $2,800 and over.

Application forms, which have to be filled out prior to March 29th, can be secured from the Civil Service Commission, Washington, D. C. Form No. 1312 should be requested.

Caproni Machine Has Preliminary Tests

Paris, Feb. 18.—On Lake Majeur, in Northern Italy, Gianni Caproni is testing his giant machine. Its passenger capacity is 100 persons, and with it Signor Caproni hopes to find a type of seaplane capable of making regular trips across the Atlantic.

The machine has a wing span of thirty-three meters and weighs twenty-four tons. Its wings may be described as of the triple triplane type, there being three sets of three, one behind another at different altitudes. These wings are the newest innovations in its construction.

Eight motors of 400 horsepower each are used and the speed obtainable is estimated at 150 kilometers an hour. The crew will consist of three pilots and two mechanics. In the cabin, which has the appearance of a large motor launch, there are seating accommodations for 100 persons.

The first test with the machine was made some days ago on Lake Majeur. No attempt was made at a flight, but during the trials on the surface the machine lifted itself a few feet from the water and "taxied" in a completely satisfactory manner.

If further tests prove as successful, Signor Caproni intends to put in hand at once the construction of another and still larger machine of the same type, with cabin space for 300 persons, with which he will attempt a transoceanic flight, probably to the United States, and will seek to inaugurate a transatlantic passenger service.

French Ace is Guest of Aero Club

A reception in honor of Captain Nungesser, the famous French ace, was held at the Aero Club House, 11 East Thirty-eighth Street, on February 18th. Captain Nungesser was accompanied by the Marquis de Charette and Theodore Mathieu, aeronautical engineer, and all were welcomed by the pilots and other members of the club who had gathered to greet them. In an informal talk the French ace mentioned that he hoped in the near future to announce a new machine that would have far-reaching effects on the progress of commercial aviation. Besides being an expert pilot, he is a designer of planes and is also head of a flying school at Orly, near Paris.

Miss Laura Bromwell, who has the unique distinction of being the only aerial policewoman in the world. She is a Captain in the New York Aerial Police Corps

Aerial Mail Pilot Makes Good Speed

A new air record between Reno and San Francisco was established last week, when Pilot Stanhope S. Boggs of the United States Aerial Mail Service covered the 187 miles in 1 hour and 19 minutes, a rate of more than 139 miles an hour. This bests the previous record by five minutes.

Air Routes in California

The Aero Club of Southern California has proposed a number of novel or flying routes over the mountain and desert sections of the southwest. Most of these have been flown over by California or Air Service aviators, but there are also untraveled air routes which offer fascination for the explorer.

The desert sections are especially interesting to the man who wishes thrills, for he is passing over territory where prospectors and explorers have taken weeks to travel while he accomplishes the trip in an hour or so.

One of the touring routes laid out by the Southern California Club is called the "Quentin Roosevelt Air Lane," named after the son of the former President because it passes over the Roosevelt National Park, which was named in memory of Theodore Roosevelt. This route leaves the Los Angeles flying fields and strikes northward over the mountains to Bakersfield, then up the fertile San Joaquin Valley to Fresno. From Fresno the route is westward following the Piute Pass and Huntington Lake highway across the high Sierra Ranges to Bishop on the east side of the Sierra Nevadas. The route then turns southward down the Owens Valley between Mt. Whitney and Death Valley, following the Los Angeles Aqueduct for nearly 200 miles, and crossing the Mojave desert and the Sierra Madre range to return to Los Angeles.

This route is a series of spectacular and scenic wonders. The trip between Los Angeles and Bakersfield follows the famous "ridge" route of the California State highway which crosses the range. From Bakersfield north the route turns toward Mt. Whitney to cross the Roosevelt National Park with its great trees, and north of that the General Grant National Park and Kings River Canyon. A section of the trip crosses high and very rugged mountain peaks south of the Yosemite Valley with landings on meadows in the mountains.

The Owens Valley and Mojave desert side of the route furnish a very interesting and exceptionally spctacular flying. On the west side the high mountains rise abruptly to 12 and 14,000 feet, while on the opposite side the Death Valley region may be plainly seen. On the desert the landings are offered by dry asphalt lakes which are as smooth as pavement.

Another route charted, with the assistance of Dr. Ford A. Carpenter of the Aeronautic Department of the Los Angeles Chamber of Commerce, starts from Los Angeles and involves the coast to San Diego. The route then turns inland over the mountains and passes some of the historical California Missions to Marsh field of the Army Air Service and Riverside. It then returns over the orange groves to the Los Angeles fields.

The AIRCRAFT TRADE REVIEW

La Grande Aircraft Company Organized

The La Grande Aircraft Company, Inc., has been organized in La Grande, Oregon, as distributors for the Lincoln-Standard planes. Walter E. Lees has been appointed manager for the company and cross-country passenger work and exhibitions are being arranged for the forthcoming season.

First Test on New Air Service Engine

The initial run of the new Engineering Division 700 h.p. Model "W" engine was made on January 10th, with very satisfactory results. This engine was completely designed by the staff of the Engineering Division at McCook Field. This engine is of the "W" type, having eighteen cylinders arranged in three banks of six, and develops more horsepower than any engine which has been built in the United States. The actual figures on the test have not been divulged, but are said to exceed the designer's expectations.

Test Work at M. I. T.

A new schedule of prices covering wind tunnel test work at the Massachusetts Institute of Technology has just been prepared and we shall be glad to furnish any reader with such information as he may require concerning this work.

All reports submitted by the M. I. T. include a plotting of the customary curves and the furnishing of a set of blue prints. Rush tests can be put through by overtime work at an increase in cost at from twenty-five to one hundred per cent. The usual time for the completion of a test on a single wing or model is one week from the receipt of the model.

Aeroplane Report Forms

The Army Service has compiled a most complete and practical aeroplane report form, consisting of six pages of the standard market size, 8½ x 11", punched for the usual three-ring binder, which may be obtained at any stationery store. The first page is devoted to a summary of the general characteristics of any aeroplane. The second page gives detailed description and characteristics of the aeroplane itself. The next two pages go into the details of the power plant, the tanks and controls. The fifth page carries an analysis of the weights, with remarks on the flying qualities of the craft. The sixth page is the chart for the climb, speed and r.p.m. curves.

These forms were prepared after study of all those prepared or in use in the Air Service, with such suggestions as were apparent from the forms used by allied countries.

It is believed that the standardization of a report form for aeroplanes will be of great value to the industry. It will definitely enable all aeroplanes to be described along the same lines and will make simple the comparison of different machines of the same type.

Culver Course in Aviation

A course in aviation is being offered at Culver Military Academy, in the belief that there are a number of parents who would be glad to have their sons take up this work, which presents so many interesting possibilities for the immediate future.

This course is conducted with all the thoroughness and scrupulous attention to details that has characterized other Culver undertakings, and the instruction in actual flying will be surrounded with every possible precaution to insure its safety. Thirty-nine cadets are enrolled in the present class engaged in the preliminary ground school work. The course in flying will start at once and will continue throughout the summer and early fall, being resumed in the spring. Ground school instruction will continue through the winter.

Cadets taking the aviation course will devote to it only that portion of the afternoon allotted to military instruction, approximately ten and a half hours per week. The course is open only to cadets who have completed their first year in the Academy.

Cadets taking the course in the Summer Naval School may devote to it all available time not required for physical and disciplinary drills, approximately twenty hours per week.

The course is divided into two parts, the ground school course and the flying course. Cadets, if they desire, may take the ground school course without flying.

The ground school course includes instruction in gas engines, rigging, doping, theory of flight, aerial navigation and bombing.

The flying course contemplates thirty hours of actual flying; thorough instruction will be given in conservative flying. The student will be instructed to take-off, fly a straight course, turn, glide, spiral and land. Upon completing such work the student will then be permitted to fly the plane himself with an instructor always in the plane. Acrobats or stunt flying will not be permitted other than to teach the student how to be able to control the plane in unusual positions.

A special booklet concerning the course will be sent on application to the Aviation School.

Lease on Landing Field at Moundsville, West Virginia

As a link in the chain of landing fields that must accompany the marking and charting of the airways of the United States, a lease has been arranged by which the U. S. Army Air Service gets possession of 19½ acres at Moundsville, W. Va., where a landing field will be established on the recently opened Washington-Dayton air route. The tract, which extends north and south 2,125 feet and east and west 400 feet, is Ohio River bottom land at present in cultivation. Its conversion into a model landing field will begin at once.

Aeroplanes to Hunt Seals This Season

St. John's, N. F.—It is announced that the Government will send to the ice fields two aeroplanes to locate the herd. These aeroplanes, of English design, will be operated by English airmen and will start from Botwood, where work is being rushed on the aerodrome. H. R. Brookes, president of the Newfoundland Board of Trade, is to accompany the flying expedition.

It has been decided by owners of sealing ships to fish on a limited scale, the Government assuring them that the sealing laws will be amended to let steamers sail March 10, to allow the killing of all kinds of seals, to permit the use of guns and to grant the option of second trips.

At a conference with Premier Squires the owners declared that these amendments are justified by the heavy outlay for a voyage and the probable low price of seal oil this year.

Pursuit Planes in Production

The first aeroplanes to be delivered under the production orders for pursuit types have been received at McCook Field and assembled for test. The Thomas-Morse MB-3, powered with 300 h.p. Wright engine of which fifty have been ordered, is being flown to insure that the construction and operation is entirely satisfactory before proceeding with the delivery of the remaining forty-nine aeroplanes. The first production model of the Orenco "D" of which fifty are being built by the Curtiss Company has also been received and is being assembled to undergo acceptance tests.

Experimental Research on Air Propellers

This report is a continuation of a report on the same subject published in the Fifth Annual Report. The research was conducted in the aerodynamical laboratory of Leland Stanford Junior University, and the report was prepared under the direction of Dr. W. F. Durand and Prof. E. P. Lesley. The report states the results of investigations made upon numerous propeller models at the request of the Subcommittee on Aerodynamics, and contains valuable data to those interested in the design of air propellers. The discussion accompanying the report is necessarily somewhat brief, as the report is to be a part of the general report which will include a review of all the propeller investigations that have been conducted at Leland Stanford Junior University. This general report will be ready for publication with the Seventh Annual Report of the Committee.

A copy of Report No. 109 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Air-Mail Pilot Saves Life with Parachute

Minneapolis, Feb. 18.—C. C. Eversole, pilot of a Government mail aeroplane, leaped from the machine here to-day when it was disabled and began to fall from a height of 3,000 feet and saved his life by means of a parachute, his own invention, which he wore strapped to his back. The aeroplane struck the ground and was wrecked several minutes before the pilot floated to earth.

Eversole took off from the Minneapolis flying field soon after 10 o'clock this morning, flying a twin De Haviland. Only a few minutes later spectators on the field saw his machine was in trouble and then it went into a tail spin.

It started to fall, and Eversole crawled from the pilot's seat to the fusilage and leaped. He dropped several hundred feet before his parachute opened.

THE DETERMINATION OF DOWNWASH

By Lt. WALTER S. DIEHL

Bureau of Construction & Repair, U. S. N.

(Technical Note of the National Advisory Committee for Aeronautics)

Introduction

IT is obvious that, in accordance with Newton's second law, the lift on an aerofoil must be equal to the vertical momentum communicated per second to the air mass affected. Consequently a lifting aerofoil in flight is trailed by a wash which has a definite inclination corresponding to the factors producing the lift. It is thought that sufficient data, theoretical and experimental, are now available for a complete determination of this wash with respect to the variation of its angle of inclination to the originating aerofoil and with respect to the law which governs its decay in space.

Munk's Formula for Downwash

Although it has long been known that the angle of downwash ϵ, as observed at a given point behind the aerofoil, is directly proportional to the lift of the aerofoil (Br. A.C.A. R. & M. No. 196) and inversely proportional to the aspect ratio (Lanchester, "Aerial Flight," Vol. 1, Chapter VIII, Br. A.C.A. R. & M. No. 161), Munk (Technische Berichte III-1) seems to have been the first to propose a quantitative solution. He asserts that ϵ must be represented as the product of some constant and the angle of attack as expressed by the formula (Betz, T.B.I-4),

$$\alpha = \frac{57.3}{\pi} . 2 L_c \left(\frac{S}{b^2} \right)$$

where b is the span, L_c is the lift coefficient and S is the area of the aerofoil. The formula for downwash then becomes

$$\epsilon = c . \alpha = \frac{57.3c}{\pi} . 2L_c \left(\frac{S}{b^2} \right)$$

the value of the constant c being determined by experiment. The formula as given applies to monoplanes but may be applied to multiplanes, according to Munk, by the introduction of another constant k which reduces the span b to the span of the equivalent monoplane.

The values of c were determined for several models by photographing a series of streamers. Owing to the lack of certain vital data, the results have not been included in this study, but the conclusions are given instead. It appears that the equation, as given above, is not general. The values of c vary somewhat more than is allowable for a "constant". No attempt was made to determine the variation of c with aspect ratio, nor was any allowance made for the inevitable dying out or the wash effect in space. It appears, however, that the angle of downwash is substantially constant over about eight-tenths of the span, with sudden changes near the tips.

N. P. L. Formula

The most comprehensive series of tests on downwash, which have been published, are those by Sandison, Glauert, and Jones (Br. A.C.A. R. & M. No. 426). In this investigation the variation of downwash was determined in space for a number of points behind, above, and below the trailing edge of the aerofoil. It was found that, in accordance with hydrodynamic theory,* the angle of downwash decreases exponentially with the distance from the aerofoil (a biplane in this case) and might be expressed by the empirical formula

$$\epsilon = \epsilon_0 10^{-0.05\,\xi - 0.08\,\zeta}$$

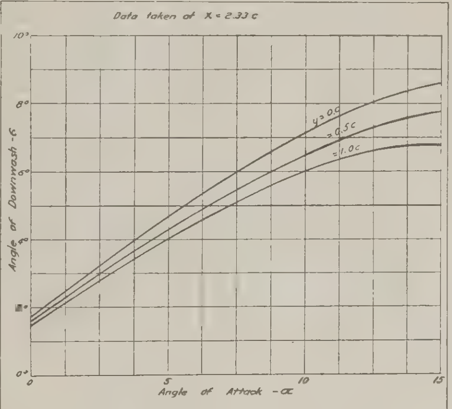
where

ξ is the distance behind the wing in chord lengths,

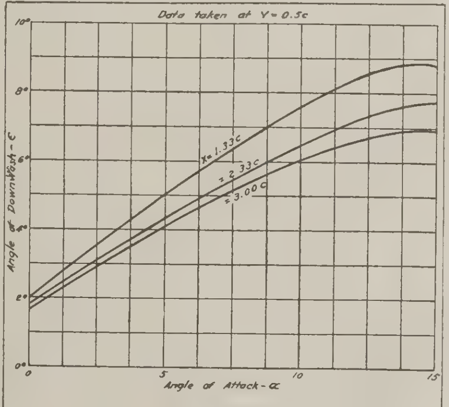
ζ is the distance below the chord of the upper wing in terms of the gap.

and ϵ_0 is a constant for any given arrangement.

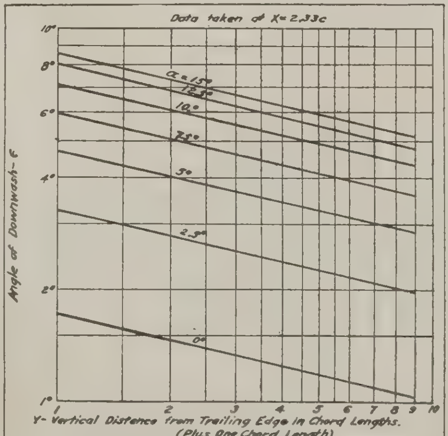
This appears to have been the first attempt to express the variation of ϵ_0 from point to point. With a satisfactory law for the variation of ϵ_0 it would have been complete.



VARIATION OF ANGLE OF DOWNWASH WITH DEPTH Y BELOW UPPER WING. From R. and M. No. 426. Fig. 7.
Fig 1.



VARIATION OF ANGLE OF DOWNWASH WITH DISTANCE Y BEHIND WINGS. From Br. A.C.A., R. and M. No. 426. Fig. 7.
Fig. 2.



Y - Vertical Distance from Trailing Edge in Chord Lengths. (Plus One Chord Length)
VARIATION OF ANGLE OF DOWNWASH WITH DEPTH BELOW WING.
Fig. 3.

Derivation of a Comprehensive Downwash Formula

It is now possible to derive a comprehensive downwash formula based on the Gőttingen theoretical and the N.P.L. empirical formulae. It is known definitely that downwash varies exponentially with distance from the trailing edge. The plotted results of N.P.L. investigations, which show this variation vertically and horizontally, are given in Figs. 1 and 2, respectively. The data in Fig. 1 have been replotted on a logarithmic scale in Fig. 3, with the vertical distance from the trailing edge expressed in chord lengths plus one chord length* as abscissa and angles of downwash as ordinates. It is found that for a given angle of attack, the angles of downwash at various vertical distances from the trailing edge lie on a straight line. The lines corresponding to the various angles of attack are all parallel and have a slope of —13° ± 0.5°. This indicates that the variation of angle of downwash with vertical distance from the trailing edge can be represented by an equation of the form:

$$\epsilon = c_2 \, (y + 1)^n,$$

where c_1 = a constant,

y = the vertical distance, of the point under consideration, in chord lengths, from the trailing edge,

and $n = \tan\,(-13° \pm 0.5°)$

$= -0.23 \pm 0.01.$

In a similar manner the data from Fig. 2 have been plotted in Fig. 4. The points again fall near parallel straight lines but their slope, —21° ± 0.5°, is steeper than that in Fig. 3. The indicated variation of the angle of downwash with variation of horizontal distance from the trailing edge is of the form

$$\epsilon = c_2. \, (x + .1)^n$$

where c_2 = a constant,

x = the horizontal distance, of the point under consideration in chord lengths, from the trailing edge,

and

$n = \tan\,(-21° \pm 0.5°)$

$= -0.38 \pm 0.01.$

In order to eliminate the calculations involving fractional exponents the functions,

$$Z = (y + 1)^{-0.23}$$

and

$$Z = (x + 1)^{-0.38}$$

have been evaluated and plotted in Fig. 5.

Data from five series of downwash determinations have been plotted in Fig. 6, with angles of downwash as ordinates and

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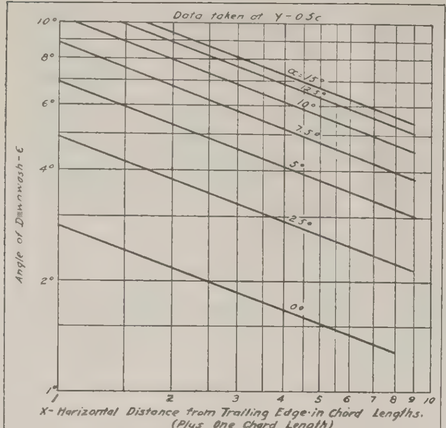
* See Lanchester, *Aerial Flight*, Vol. I, Chap. III.

* This is necessary so as to provide a finite value at the trailing edge.



VARIATION OF ANGLE OF DOWNWASH WITH DISTANCE BEHIND WING.
Fig 4.

lift coefficients as abscissae. The slope of the straight line, which passes through the points representing a series of tests, determines the value of $\Delta\epsilon/\Delta L_c$ for that particular arrangement and the point in space at which the observations were taken. The aspect ratio, the value of $\Delta\epsilon/\Delta L_c$, and the coordinates of the observation point are given, for each series of tests, in Table I.

It is evident from inspection of Fig. 6 that ϵ varies directly with lift coefficient. It has also been shown by data from the tests of Sandison, Glauert, and Jones (Br. A.C.A. R. & M. No. 426) how ϵ varies in space. Munk's equation indicates that ϵ varies inversely as the aspect ratio, n. Therefore the angle of downwash should be given by

$$\epsilon = \frac{K}{N} \cdot (x+1)^{-0.38} \cdot (y+1)^{-0.23} \cdot L_c$$

where K is a constant, numerically equal to $\Delta\epsilon/\Delta L_c$ at the trailing edge of a wing of aspect ratio unity.

The value of K is determined for each of the five series of tests which are plotted in Fig. 6, by substituting the proper values for the functions of x and y and for the aspect ratio n. The procedure is indicated by the headings of columns in Table I.

It is found that K is substantially constant, varying from 164 to 176; a single exception of 158 corresponds to a series of tests on a biplane arrangement, the wings of which were equipped with flaps and represent abnormal conditions. It therefore appears that the angle of downwash can be represented to a good approximation by

$$\epsilon = \frac{170}{n} \cdot (x+1)^{-0.38} \cdot (y+1)^{-0.23} L_c$$

$$\epsilon = \frac{170}{n} \cdot F_x \cdot F_y \cdot L_c$$

F_x and F_y being the values of the functions of x and y which are given in Fig. 5.

The validity of this formula is obviously confined to that range of angle of attack or lift coefficient in which the air flow about the aerofoil is not abnormally turbulent.

Application of the Downwash Formula

The chief use of a downwash formula is the calculation of the aerodynamic angle of attack of the horizontal tail surfaces. For this purpose a reference point is taken on the leading edge of the horizontal tail surfaces and the values of ϵ obtained from the formula. The aerodynamic angle of attack of the tail surfaces will then be

$$a_t = a - \beta - \epsilon$$

where a is the angle of attack of the wing and β is the acute angle between the chord lines of the wings and horizontal tail surfaces, considered positive (in the equation) if the tail is set at a less apparent angle than the wings.

The data from tests seem to indicate that in case of a biplane the maximum angle of downwash occurs in the horizontal plane midway between the two wings. The effect is so slight, however, that the above method may be used, referring the coordinates of the reference point to the nearest wing (preferably to the no lift line), with the assurance that the results so obtained will be as precise as it is practicable to calculate them with the data now available.

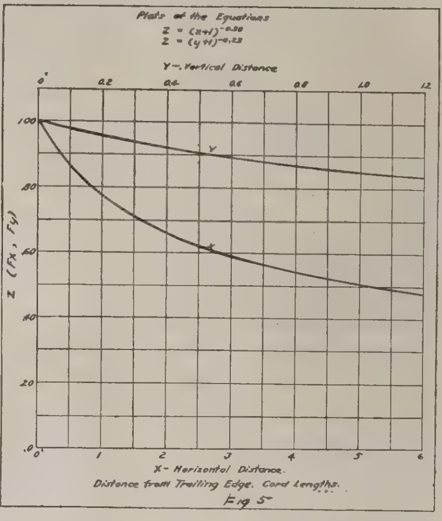
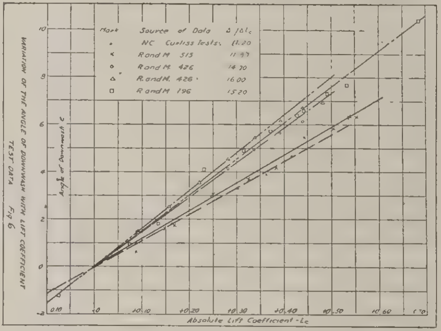


Fig 5



VARIATION OF THE ANGLE OF DOWNWASH WITH LIFT COEFFICIENT
TEST DATA
Fig 6

TABLE I

DETERMINATION OF K IN THE EQUATION

$$\epsilon = \frac{K}{n} \cdot F_x \cdot F_y \cdot L_c$$

Source of Data	Aspect Ratio n	$\frac{\Delta\epsilon}{\Delta L_c}$	x	y	F_x	F_y	$\frac{\Delta\epsilon}{\Delta L_c}\left(\frac{F_x \cdot F_y}{1}\right)$	$K = \frac{\Delta\epsilon}{\Delta L_c}\left(\frac{1}{F_x \cdot F_y}\right) \cdot n$
NC-1 Curtiss Tests	9.5	11.20	2.5	0.00	.625	1.00	17.9	170
R.&M. No.196..	6	15.20	2.3	0.55	.64	.90	26.4	158
R.&M. No.426..	6	14.70	3.0	0.61	.595	.89	27.8	167
R.&M. No.426..	6	16.00	3.0	0.43	.595	.915	29.3	176
R.&M. No.515..	7.73	11.8	2.6	0.6	.62	.895	21.3	164

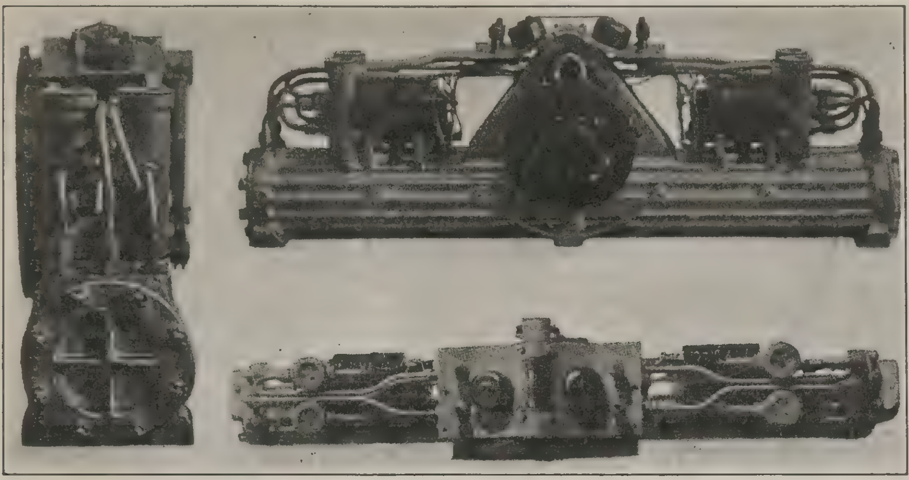
NOTE:—There will be a slight decrease in the value of $\Delta\epsilon/\Delta L_c$ with increase in lift coefficient if the reference point is not fixed in space. This is caused by the change in the coordinates of the point with change in angle and the effect may easily be accounted for.

Let D = distance from trailing edge, T, to reference point P
Θ = Inclination to horizontal of line TP
then $x = D \cdot \cos\Theta$
$y = D \cdot \sin\Theta$

THE AVELINE AUTOMATIC PILOT

FROM the earliest days of flying, inventors have occupied their minds with mechanical apparatus whereby the equilibrium of an aeroplane could be maintained without the aid of the pilot. One of the first, and most obvious, solutions of this problem was the pendulum, and inventions out of number utilizing the pendulum principle have been patented. Some of these have been very ingenious, but when reduced to elementary principles have proved to be but some form of pendulum gear after all. Now the pendulum control is taboo on account of the fact that, although under certain conditions it will do what is required of it, it suffers from the disadvantage that it is acted upon by centrifugal force and by acceleration. This results in incorrect readings when the instrument is used as an indicator, and may mean a crash if the pendulum is used for operating, directly or indirectly, the controls. As a variation of the pendulum type of stabilizer, gyroscopes have been suggested, and several types have in fact been made and have proved to work satisfactorily. Perhaps the best-known of gyroscopic stabilizers is the Sperry, which was used with success on several machines, notably large flying boats. Although this instrument worked very well, it never came into general use, probably because a gyroscope is, at the best of times, a delicate piece of machinery likely to get out of action. Moreover, the gyroscope with its attendant servomotors and other paraphernalia weighs a good deal, and this, coupled with the various complications, has probably prevented the Sperry gyroscopic stabilizer from becoming as popular as it otherwise would have done.

Recently a form of "automatic pilot" has



Elevation, side view and plan of the Aveline Stabilizer

been introduced, in which the pendulum principle is involved, but in which the objectionable features of the pendulum control have been avoided, or rather countered. This machine is the invention of a young Frenchman, M. Georges Aveline, who has succeeded in forming a company for exploiting his patents in Britain. This firm is established as Automatic Controls, Ltd., with offices at 19, Regent Street, and at the present moment Messrs. Handley Page, Ltd., are carrying out a series of practical tests of the invention at their Cricklewood aerodrome. We understand that previously the "automatic pilot" has been tested by Air Ministry pilots, but the Handley Page tests are the first to be carried out by a private firm. During a series of tests by Major H. G. Brackley, D.S.O., the well-known H.P. pilot, the Aveline stabilizer has functioned very well indeed, and although there are still minor adjustments to be made the invention has already proved extremely promising.

The Principle of the "Automatic Pilot"

As has already been mentioned, the Aveline stabilizer employs a form of the pendulum principle, and part of the machine is electric, part pneumatic, and part aerodynamic. The pendulum portion, which is only partly to be regarded as a pendulum, consists of an inclinometer in which the fluid is mercury. This mercury is contained in a disc with a narrow circular groove, and serves to make and break an electric contact which operates the valves that admit compressed air to the air cylinder whose pistons actuate the control cables. A reference to the accompanying diagram should help to give an idea of the fundamental principles involved. This diagram, by the way, is not meant to represent the actual mechanism except in so far as concerns elementary principles, being neither to scale nor representing in component details the actual machine. It has been drawn solely in order to assist in fixing ideas, and deviates in many respects from the machine itself. We have thought this would form a better explanation of the idea of the invention than a more accurate and complicated set of drawings of the actual details, and presently we shall attempt to indicate wherein the machine itself differs from the diagram.

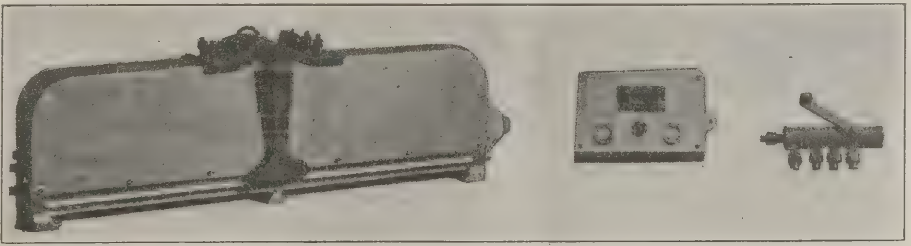
Having made this proviso, one may proceed to a description of the apparatus. To begin with the inclinometer, and taking first that for *aileron* controls (there is a separate one for the elevator). This consists of a fibre disc in which is a circular groove approximately half filled with mercury. Passing into this circular groove, and a small distance above the level of the two ends of the mercury, are two electric contacts, while a third contact is placed at the bottom of the disc. To these contacts are passed wires from a 4-volt electric battery. In the actual machine one only is employed, but in order to keep the wiring diagram as simple as possible we have shown a battery for each side. It will now be seen that if the disc is tilted the mercury will rise on one side, thus closing the electric circuit on that side. The relay current of 4 volts on being closed actuates a solenoid switch, which closes a stronger circuit of 12 volts. This in turn actuates the valve mechanism of the working cylinder, which is supplied with air from a container. Two turbine pumps running at 2,000 r.p.m. keep up a pressure of about 50 lbs. per sq. in. in the air container. These two pumps are driven by two windmills, mounted under the front portion of the *fuselage*.

Suppose the left wing of the machine is tilted downward by a gust or through some other cause. The mercury will then rise in the left-hand side of the disc, and will make a contact with the left-hand circuit. This closes the left-hand 12-volt circuit, and the solenoid shown at the left end of the working cylinder closes the exhaust valve and opens the inlet valve, thus admitting air from the container to the cylinder. The pressure of the air forces the piston to the right, and as the rigid connecting rod is provided with a rack engaging with the teeth of the quadrant above it, the quadrant is turned anti-clockwise. Secured to the same spindle as the quadrant, and projecting downwards from it, is a lever, shown dotted) to which are attached the *aileron* cables. It will now be seen that as the pistons and connecting rod travel to the right the quadrant and the lever behind it move also to the right, pulling down the port aileron and thus righting the machine. This, briefly, is the principle of the mechanism, and later we shall indicate detail differences between diagram and actual machine.

The Original Feature

Hitherto the stabilizer has not shown any very great originality. All its components have been used or suggested before. We now come to the feature which separates the Aveline stabilizer from all others with which we are acquainted. Let us return to the diagram once more. If we suppose that the pilot of the machine does a flat left-hand turn, it will be seen that centrifugal force would send the mercury up in the right-hand side of the disc, indicating that the machine is down by the starboard wing when, as a matter of fact, she is perfectly level, merely doing a flat left-hand turn. In other words, the mercury is acting precisely as would a pendulum. In order to counter this tendency to rise and fall with the action of centrifugal force, M. Aveline has had the brilliant idea of letting air pressure work against centrifugal force, thus keeping the mercury level. This has been done by the very simple means of fitting to each wing tip a Venturi tube. The Venturi tube on the port wing tip is connected to the right-hand end of the mercury and vice versa. In other words, the pipe leads from the tubes are crossed. Between the two points where the tubing enters the circular groove the latter is closed. Now the action of the Venturi tubes is to cause a depression above the mercury. When, therefore, the machine turns to the left, the starboard Venturi tube is moving faster, causing a greater depression over the left branch of the mercury. The port Venturi tube, on the other hand, is moving slower, and consequently the depression is smaller on the right-hand side. Both these differences in pressures tend to prevent the mercury from being raised into the right-hand branch of the circular groove and there make contact and set in motion the mechanism which would pull the starboard *aileron* down. Put differently, the action of centrifugal force is counteracted by the aerodynamic forces brought into play by the Venturi tubes.

The set for the elevator is similar in general principle, with, however, one important difference. Here only one Venturi tube is employed, the opening for the second one communicating with the atmosphere. A few minutes' consideration will make clear the reason for this arrangement. When the machine is traveling along at normal flying speed there is a slight depression, depending upon the speed of the machine, above the corresponding end of the mercury. The effect of this is to raise the mercury into the forward end of its groove, and as this condition represents the zero line, or plane of reference of the elevator system, the two metal contacts are so placed as to be just above the ends of the mercury. In other words, the normal level of the mer-



THE AVELINE STABILIZER: On the left, a rear view of the casing over the working cylinder, showing the crank lever to which the control cables are attached. On the right, the relay tell-tale lamps and one of the control valves by means of which the pressure, and consequently the power of the control, is regulated. When the lever points forward the control is in gear, and turning the lever back throws the control out of gear cury is at an angle with the horizontal. If the machine is flying along at, for instance, 60 m.p.h., and the engine stops, the speed will drop. Consequently the depression above the forward end of the mercury will decrease, and the mercury will fall, rising at the other end until it makes contact at the lower end, and thus sets in motion the gear for pulling the elevator down until the speed, coupled with the downward slope of the machine, breaks contact and the machine proceeds in a glide.

Some Interesting Details

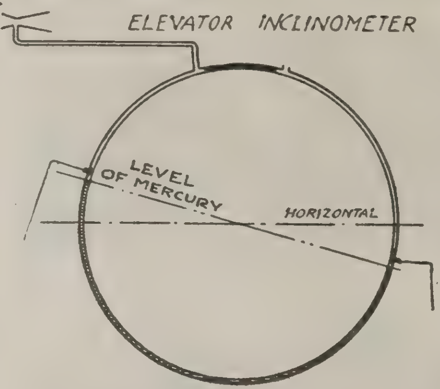
The foregoing is a broad outline of the action of the Aveline stabilizer. It will have been observed, however, that so far nothing has been said regarding the method of returning the pistons of the working cylinder to zero when the machine begins to right itself. As shown in the diagram, the inclinometer, or disc with the mercury, tilts with the machine. When, therefore, the machine begins to right itself there is nothing to prevent the pistons from travelling to the end of their stroke until the machine has "overshot the mark," and makes the contact on the opposite side. This would give rise to oscillations, and to avoid these the actual arrangement of the apparatus is different from that shown in the diagram. Instead of being mounted on the machine itself, the inclinometer is mounted in front of the working cylinder, its axis carrying a quadrant pointing upwards and engaging with a smaller quadrant on the same pivot as that of the main quadrant.

There is, therefore, a differential movement between the mercury disc and the main quadrant, so that when the quadrant turns in an anti-clockwise direction the mercury disc turns in the opposite direction. The action is somewhat difficult to explain in words, but the two auxiliary quadrants are shown in dotted lines on the diagram, as is also the mercury disc in its proper position. The result of the differential movement is to shut off the air and so to stop the travel of the pistons.

A similar arrangement is provided for the elevator control, but here, in addition to the differential movement of the disc and quadrant, the "setting" of the disc is also under the control of the pilot. This is necessary in order to trim the machine. For any one setting the controls will keep the machine at one speed. If, therefore, it is desired to fly at a different speed, the pilot turns a handle in his cockpit, which—*via* a Bowden cable, worm and sector—alters the relative position of quadrant and disc. In other words, a new reference plane is provided, which forms the zero or normal datum line to which the controls return the machine every time it has deviated from it through any cause.

Adjustment of the Stabilizer

It has already been mentioned that the two air pumps keep up a pressure of in the neighborhood of 50 lbs. per sq. in. in the air container. If this pressure were to be admitted to the working cylinder the controls would operate very brusquely and the machine would "hunt." In order to avoid this a small valve is provided in the pilot's cockpit by means of which the pressure of the air admitted to the working cylinder can be regulated to a nicety. There is no need to go into a detailed description of this valve, suffice it to mention that it regulates the air by means of a disc with holes of different sizes, ranging from 1mm. to 4 mm. in diameter. On the barrel of this valve is a small lever which, by means of a cam and internal pistons, covers and /or uncovers the four tubes issuing from this small cylinder. When the lever is pointing forward the control is in operation, while by turning it back the control is out of gear. There are two of these levers, one for elevator and one for *ailerons*. Thus the pilot can throw either or both out of gear at will. For instance, he can control the elevators himself and have the stabilizer work the *ailerons* only. Or he can set the elevator adjustment to any angle of climb or to straight flight, and control the *ailerons* himself. Finally, he can throw the entire mechanism out of gear by means of a single lever, when he has straight-through control as if the stabilizer were not fitted at all.



THE AVELINE STABILIZER: Diagram of the elevator inclinometer. Here there is only one Venturi tube, the opening for the second one communicating with the atmosphere. The suction of the Venturi tube causes the mercury to rise in the forward branch, so that its normal level is at an angle to the horizontal

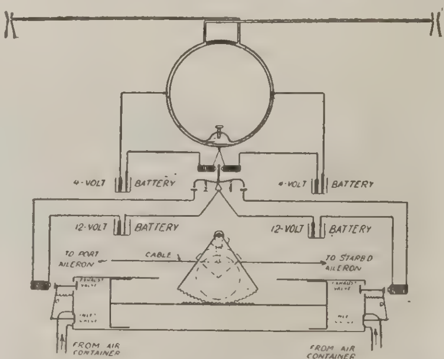
Using the Stabilizer as an Indicator

Connected up with the relay electric circuit are two pairs of electric lights, one pair for the *ailerons* and one for the elevator. When the stabilizer is working these lights burn as soon as contact is made by the mercury. For instance, if the left wing tip drops, the mercury makes contact on the left-hand side, and the little lamp on the left lights up and continues to burn until the circuit is broken. Thus the pilot can see all the time what is taking place. For instance, if the machine commences to "hunt," *i. e.*, overcorrecting the elevator control, the front and rear lamps of the indicator will light up alternately. When both go out the pilot will know that balance has been restored, and that the machine is flying at the angle and speed for which it has been set.

If the two levers are swung back, the control is not working, but if the switches are left "on," the light will still continue to act, and the inclinometer and relay circuit are working as indicators merely.

The Actual Working Cylinder

It has been mentioned that the actual working cylinder of the machine is somewhat differently arranged from the arrangement shown in the diagram. For instance, the valves are not in the cylinder heads, but above, near the end of the cylinder, as will be seen from the photograph. Also, normally all valves are closed, and when air is admitted to one end of the cylinder the exhaust valve of the opposite end is opened. When all the valves are closed and the pistons are travelling towards their central position, a valve is opened above the cylinder and the air is allowed to pass from the end towards which the piston is moving to the opposite end, where it fills the space vacated by the retreating piston. When this happens, therefore, there is only the frictional resistance of the pistons and the air through the bypass tube to overcome. To have shown all this piping would have made the diagram complicated, and we have preferred to keep the diagram simple and to point out the difference between it and the actual arrangement.



THE AVELINE STABILIZER: Diagrammatic sketch of the elementary principles of the control. The inclinometer is shown above the control quadrant. On the actual machine it is mounted on a smaller quadrant engaging with a still smaller one, as indicated by the dotted lines

The Stabilizer in Practice

There are numerous other minor details of the stabilizer to which we should have liked to make reference, but space does not allow of doing this. Sufficient has, we think, been said to indicate the manner of working and to show the thorough way in which the inventor has grasped the problems to be solved. That the machine is absolutely perfect as yet is not, we think, claimed, but such difficulties as still exist are of a very minor character and will doubtless soon be overcome. For instance, it will be realized that when a machine fitted with the stabilizer meets a "head-on" gust, the Venturi tube will raise the mercury until it makes contact with the "up-elevator" circuit, thus making the machine swoop. This is, however, only what happens in any longitudinally stable machine, and if the swoop be too great, the differential movement of the disc will break that circuit and close the "down-elevator" circuit.

That the invention is of more than ordinary interest from a technical point of view, will, we think, be generally admitted. What are its practical applications? In the first place the weight of the apparatus is considerable. Even granted that by future development and simplification the weight can be got down to, say 150 lbs., this will still mean that the equivalent of one passenger is expended on carrying the device. On the London-Paris journey this will mean, at the present fares, a loss of £18 18*s*. on the double journey. This is a serious consideration, and unless the device can save the pilot from a considerable amount of strain it will not be tolerated. That it will do so is more than probable, and a fact which will have to be kept in mind when trying to form an opinion of the value of the device is that it is probably not on very many journeys that the full complement of passenger or goods is carried. In that case there is no loss due to carrying the device, other than a small one in petrol consumption, and that, probably, is negligible.

There is one sphere in which the stabilizer does appear to score heavily: that of flying in fog or clouds. Normally, when the pilot is in a cloud he has, after a time, very little notion of what is the altitude of his machine. For all he knows he may be flying around in circles, and usually the only indication he has is that his compass appears suddenly to have gone mad. As to how to get out of his difficulty he is very much in the dark.

(*Concluded on page 667*)

THE STEADINESS FACTOR IN ENGINE SETS

By W. MARGOULIS

Aerodynamical Expert, Paris Office, N.A.C.A.

THE following discussion on the Steadiness Factor in Engine Sets was prepared by the Paris Office of the National Advisory Committee for Aeronautics.

1. Formula of the Steadiness Factor in Engine Sets

In a paper* "On the Flywheel Effects of Aviation Engines," M. Lecornu points out that the usual method of determining the steadiness factor cannot be applied to aviation engines coupled to a propeller because, in this case, the resisting torque is a function of the angular speed of rotation, and not of the angle of rotation of the crankshaft.

For engine sets, the equation of motion, according to M. Lecornu is:

$$I \omega \frac{d\omega}{d\theta} = C_e - l\omega^2 \qquad (1)$$

in which

$I =$ the moment of inertia of the flywheel effect and propeller;
$\omega =$ the angular speed of rotation;
$\theta =$ the angle of rotation of the crankshaft;
$C_e =$ the torque of the engine on the crankshaft (brake torque)
$l\omega^2 =$ the resisting torque of the propeller

Integrating formula (1) we obtain:

$$\omega^2 = \frac{2l}{I} e^{-\frac{2l\theta}{I}} \int_0^\theta \frac{C_e}{l} e^{-\frac{2l\theta}{I}} d\theta \qquad (2)$$

But in four-stroke multicylindered engines, the brake torque may be represented with sufficient approximation by the equation:

$$C_e = C_{me} + \frac{\Delta C_e}{2} \frac{\sin N\theta}{2} \qquad (3)$$

in which C_{me} is the mean value of the brake torque;

$\Delta C_e = C_e(\max) - C_e(\min)$
$N =$ the number of cylinders.
$\theta =$ angle of rotation of crankshafts.

Replacing C_e in formula (2) by its value taken from formula (3) and integrating, M. Lecornu obtains as formula of the Steadiness Factor:

$$\frac{\omega}{\omega \max - \omega \min} = \frac{\omega}{\Delta\omega} = r_h = \frac{C_{me}}{\Delta C_e} \frac{\sqrt{IN^2 + 16l^2}}{2l} \qquad (4)$$

2. Reduced Mass of Parts in Motion of Aviation Engines

In the equation of motion (1) M. Lecornu has not allowed for the mass of the parts in motion of the engine itself, such as pistons, connecting rods and crankshaft, whose moments of inertia cannot be ignored. Nor has he taken into account the variation of the brake torque as function of the variation of the angular speed of rotation, nor of the resisting torque of the engine itself.*

If the reduced mass of the engine parts in motion (that is, the mass of the parts reduced to a point distant from the axis of the engine by the unit of length) were constant, the equation of motion would be:

$$(I + \mu) \omega \frac{d\omega}{d\theta} = C_i - l\omega^2 \qquad (5)$$

in which I is, as before, the moment of inertia of the fly wheel effect and propeller

μ is the reduced mass of the other engine parts in motion
C_i is the torque indicated which does not depend on the speed of the engine
$l\omega^2$ is the resisting torque of the engine and propeller; in point of fact, the resisting engine torque may be expressed by the formula $a + b\omega^2$ in which a is very small and may be ignored. Moreover, if we take a into account (which we must do in studying low speed régimes) the following formulas will not be modified, on condition that we admit $C_{mi} = C_{mi} - a$.*

We will examine in detail the conditions required for the reduced mass of the parts in motion of an aviation engine to remain constant.

We know that the mass of engine parts in motion, reduced to the axis of a crank (μ_1), is expressed by the formula:

$$\mu_1 = M_a + N \times 0.75\, M_b + \Sigma\, (M_p + 0.25\, M_b) \frac{v^2}{w^2} \qquad (6)$$

in which

$M_a =$ the reduced mass of the crankshaft
$M_b =$ the mass of a connecting rod
$M_p =$ the mass of a piston
$v =$ the speed of the piston
$w =$ the rim speed of the axis of a crankpin

In this expression the term v^2/w^2 has the value:

$$\frac{v^2}{w^2} = (\sin\theta + \frac{n}{2} \sin 2\theta)^2$$

in which n is the ratio of the radius of the crankpin to the length of the connecting rod, a ratio which, in what follows, we assume equal to 1/5.

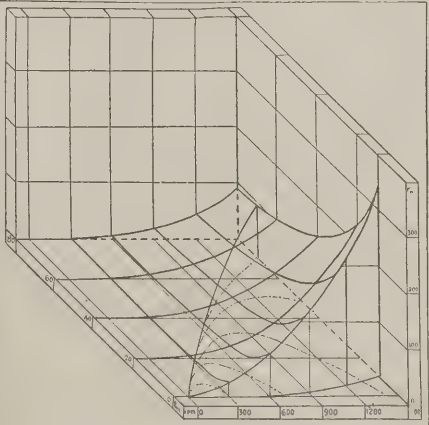


Fig. 1.
STEADINESS FACTOR FOR A 60 I.H.P. ENGINE.

Developing the term v^2/w^2 in a Fourier's series, we obtain:

$$\frac{v^2}{w^2} = \frac{1}{2} + \frac{n^2}{8} + \frac{n}{2} \cos\theta - \frac{1}{2} \cos 2\theta - \frac{n}{2} \cos 3\theta - \frac{n^2}{8} \cos 4\theta \qquad (7)$$

To express the reduced mass we have therefore:

$$\mu_1 = M_a + N \times 0.75\, M_b + (M_p + 0.25\, M_b)\,(0.505\, N + A) \qquad (8)$$

in which

$$A = \Sigma \left| \frac{n}{2} \cos\theta - \frac{1}{2} \cos 2\theta - \frac{n}{2} \cos 3\theta - \frac{n^2}{8} \cos 4\theta \right| =$$

$$+ n/2 \{ \cos\theta + \cos(\theta + \alpha) + \cos(\theta + 2\alpha) + \dots \}$$
$$- 1/2 \{ \cos 2\theta + \cos(2\theta + 2\alpha) + \cos(2\theta + 4\alpha) + \dots \}$$
$$- n/2 \{ \cos 3\theta + \cos(3\theta + 3\alpha) + \cos(3\theta + 6\alpha) + \dots \}$$
$$- n^2/8 \{ \cos 4\theta + \cos(4\theta + 4\alpha) + \cos(4\theta + 8\alpha) + \dots \} \qquad (9)$$

θ is the angle made at the moment under consideration by the crankpin of any cylinder taken as a reference cylinder, with the axis of this cylinder; $\theta + \alpha$ is the same angle of the cylinder the stroke of which precedes that of the reference cylinder, the condition of equality of the intervals between the strokes requiring $\alpha = 4\pi/N$.

Expressions (8) and (9) show that the reduced mass is equal to a constant plus the sum of 4 series of cosines of N arcs increasing in arithmetical progression in the ratio of $4\pi/N$, $8\pi/N$, $16\pi/N$, and $32\pi/N$, each of these series being multiplied by a certain numerical factor.

Now, we know that these series are null or equal to N Cos θ, N Cos 2 θ .... according as the ratio

$$\frac{4\pi}{N} = 2\pi, \frac{8\pi}{N} : 2\pi \dots$$

is a fraction or a whole number.

We may therefore write:

$$\frac{n}{2} \{ \cos\theta + \cos(\theta + \alpha) \dots \} = 0, \text{ when } \frac{2}{N} \text{ is a fraction, or } = \frac{n}{2} N \cos\theta$$

$$-\frac{1}{2} \{ \cos 2\theta + \cos(2\theta + 2\alpha) + \dots \} = 0, \text{ when } \frac{4}{N} \text{ is a fraction, or } = -\frac{1}{2} N \cos 2\theta$$

$$-\frac{n}{2} \{ \cos 3\theta + \cos(3\theta + 3\alpha) + \dots \} = 0 \text{ when } \frac{6}{N} \text{ is a fraction, or } =$$

---

* See Transactions of the Académie des Sciences, 1909.

* In fact, the effective moment depends on the diagram of the pressures indicated and on the forces of inertia of the pistons and connecting rods, which are a function of the variation of the angular speed. To determine the effective moment we generally calculate the forces of inertia by assuming that the speed of rotation is constant and that the resisting engine torque is null; but this is only a first approximation.

* In the most usual case the equation of motion is

$$(I + \mu) \omega \frac{d\,\omega}{d\,\theta} = C_i - a - n\,\omega - l\omega_2$$

$$-\frac{n}{2} N \operatorname{Cos} 3\theta$$

$$-\frac{n^2}{8}\{\operatorname{Cos} 4\theta + \operatorname{Cos}(4\theta+4\alpha) + \ldots\} =$$

$$0 \text{ when } \frac{8}{N} \text{ is a fraction, or } =$$

$$-\frac{n^2}{8} N \operatorname{Cos} 4\theta$$

The maximum values of each of the series being in the ratio of 1/10 to ½ to 1/10 to 1/200, we may ignore the fourth series.

We thus arrive at the following conclusion:

The reduced mass of the parts in motion of an aviation engine is constant when the number of cylinders, being off, is greater than 3; and also when the number of cylinders is even and greater than 6.

It follows that if the number of cylinders is 5, 7, or upwards, the equation of motion (5)

$$(I + \mu)\, \omega \frac{d\omega}{d\theta} = C_i - l\omega^2 \qquad (10)$$

may be strictly applied.

The steadiness factor may thus be determined with scrupulous exactitude either by making a graphical integration of the expression:

$$\omega^2 = \frac{2l}{I} e^{\frac{-2l\theta}{I}} \int_o \frac{C_i}{l} e^{\frac{-2l\theta}{I}} d\theta \qquad (11)$$

or by the approximate expression:

$$r_h = \frac{C_{mi}}{\Delta C_i} \frac{\sqrt{IN^2 + 16l^2}}{2l} \qquad (12)$$

in which C_{mi} is the mean torque indicated;

$$\Delta C_i = C_i(\text{max}) - C_i(\text{min});$$

I is the sum of the moment of inertia of the steering wheel and propeller plus the reduced mass; the value of the latter is, as shown above, for most aviation engines equal to:

$$\mu = \mu_1 r^2 = r^2$$

$$\{M_a + 0.876\ NM_b + 0.505\ NM_p\}$$

r being the radius of the crankpin;

$$l = C_{mi}/\omega^2.$$

We may remark that in formula (12) of the Steadiness Factor, the values of C_{mi} and C_i are obtained direct from the diagram of indicated pressures, without taking into account the forces of inertia as we must do in determining C_{me} and ΔC_e.

If we compare expressions (4) and (12) we note that $C_{me}/l = C_{mi}/l$, for in both cases the values of l are, by definition, proportional to the mean torques, but that ΔC_{mi} may be different from ΔC_{me} and that the values of l differ with the mechanical efficiency of the engine, that is, from 5 to 10%.

3. Comparison of the Steadiness Factor of Engine Sets and of Engines Having a Constant Brake Torque as a Function of the Speed of Rotation

The hypothesis usually admitted in determining the Steadiness Factor is that of constant resistance. I will show that in both cases there is a very simple relation between the Steadiness Factors, and that, generally speaking, there is no appreciable difference between them.*

In the case of an engine having a constant brake torque C_{mi}, the equation of motion is:

$$I\, \omega \frac{d\omega}{d\theta} = C_i - C_{mi}$$

and as

$$C_i = C_{mi} + \frac{\Delta C_i}{2} \operatorname{Sin} \frac{N\theta}{2}$$

we obtain for the value of the Steadiness Factor:

$$r_c = \frac{\omega^2 NI}{2\Delta C_i} \qquad (13)$$

On the other hand, by substituting in expression (12), and instead of l writing its value C_{mi}/ω^2, we obtain as the value of the Steadiness Factor when the resisting torque is variable

$$r_h = \sqrt{\left(\frac{\omega^2 NI}{2\Delta C_i}\right)^2 + \left(\frac{2 C_{mi}}{\Delta C_i}\right)^2} \qquad (14)$$

Finally, if an engine has a resisting torque brake proportional to the square of the speed of rotation, but the moment of inertia I of all the parts in motion is zero, which would constitute a LIMIT for the case under consideration, we should have:

$$r_v = 2\, C_{mi}/\Delta C_i \qquad (15)$$

Comparing the expressions (13), (14), and (15) of the Steadiness Factors: r_c, $_h$ and r_v we see that:

$$r_h = \sqrt{r_c^2 + r_v^2} \qquad (16)$$

that is, *the steadiness factor of an egine set is equal to the square root of the sum of the squares of the Steadiness Factor of the same engine having a constant torque and of the Steadiness Factor of the same engine set for which the moment of inertia of all the parts in motion is zero.*

The Steadiness Factor is thus *increased* by the fact of the variation of the resisting torque, which was, moreover, evident à priori, since the propeller acts in the first place as a *steering wheel* on account of its mass, and in the second place it functions as a *regulator* by causing variation in the resisting torque. Further on we shall see, however, that the increase in the Steadiness Factor is usually negligible.

4. Quantitative Determination of the Different Steadiness Factors

From expressions (13) and (15)

$$\frac{r_v}{r_c} = \frac{4l}{NI} \qquad (17)$$

Now, if we neglect the resisting torque of the engine

$$l = \frac{C_{me}}{\omega^2} = \frac{P_m}{\omega^3}$$

in which P_m is the motive power of the engine.

We know that for a propeller having a diameter D

$$P_m = f\,(V/nD)\, \omega^3 D^5$$

Note:- The dash and dot line(-·-·-·-·)represents the value of r_c; the dash line(- - - - -) the value of r_v, and the heavy line the value of r_h.

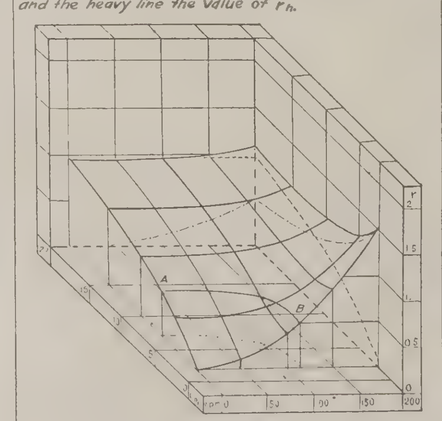


Fig. 2.

STEADINESS FACTOR FOR A 30. I.H.P. ENGINE.

We have therefore:

$$l = f\,(V/nD)\, D^5 = 0.04 \frac{P_m}{n^3 D^5} \times D^5 =$$

$$0.04\, \beta \times D^5 \qquad (18)$$

in which n is the r. p. sec. and β is the usual characteristic coefficient of the propeller.

On the other hand, if the engine has no steering wheel, as is the case with most aviation engines, and we consider a family of propellers differing only in pitch, we have approximately:

$$I = K\, D^5 \qquad (19)$$

Substituting for l and I in expression (17) their values (18) and (19) we have:

$$\frac{r_v}{r_c} = \frac{4 f\,(V/nD)}{K\, N} = \frac{0.16\beta}{K\, N} \qquad (20)$$

Now, practically, β varies between 0.005 and 0.01 $\frac{\text{Kgm/sec.}}{\text{r. p. sec. m}^5}$; on the other hand, K for the usual two-blade propeller = 0.003 Kgmass/m³; therefore:

$$\frac{r_v}{r_c} \quad \frac{0.267 \text{ to } 0.534}{N} \qquad (21)$$

For N = 4, $r_v/r_c = 0.065$ to 0.130

Equation (16) may be written as follows:

$$r_h = r_c \sqrt{1 + (r_v/r_c)^2} = r_e$$

$$\sqrt{1 + 0.0042 \text{ to } 0.017} = r_c$$

From this study we may therefore conclude that: *the Steadiness Factor of the engine sets used in practical work may be determined by the usual formula which assumes a constant resisting torque.*

5. Variations of the Steadiness Factor for a Given Engine

It is useful to take into account the variation of the Steadiness Factor for a given engine as function of the angular speed and of the power when the gas intake is varied.

We have demonstrated above that

$$r_h = r_a = \frac{\omega^2 N.\, I}{2\Delta C_i}$$

We may also admit that

$$\Delta C_i = a + bC_{mi} \qquad (22)$$

Therefore

$$r_h = \frac{NI}{2} \frac{\omega^3}{a\omega + b P_{mi}} \qquad (23)$$

which shows that *for a given engine the Steadiness Factor depends only on the speed of rotation and power.*

As an example we have laid off (see Fig. 1), in the plane XY, the group of characteristics at different gas admissions of a radial type, 5-cylinder engine, of 60 indicated horsepower at 1,200 r.p.m. The r.p.m. are laid off on the axis of X, the indicated powers on the axis of Y, and the values of r_h on the axis of Z.

The figure shows that the Steadiness Factor is diminished when the number of revolutions is reduced and the power increases.

The variation of the Steadiness Factor of an engine set composed of the engine in question and a propeller would be determined by plotting the propeller curves $P_m = f\,(n)$ in the plane XY for different values of V/nD. If the mechanical efficiency ρ of the engine is admitted to be constant, these curves would be of the form:

$$P_{mi} = \frac{\beta n^3 D^5}{\rho} \qquad (24)$$

The value of β varies little for a propeller fitted on a given aeroplane; it increases slightly when the speed of the aeroplane decreases, as in a climb, for instance.

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* This conclusion is not in agreement with that of M. Lecornu, who says: "Formula (4) by means of which we calculate the steering wheel of an aviation engine, has no resemblance whatever to the ordinary formula."

Fig. 1 and formula (23) show that the Steadiness Factor of an engine set mounted on an aeroplane decreases slightly when the incidence is increased without any change being made in the gas intake, and increases when intake increases, incidence remaining constant.

6. Minimum Speed of Rotation

The minimum speed of rotation is of practical importance, since it determines the minimum thrust of the propeller, both in aeroplanes and ships.

The minimum Steadiness Factor is equal to ½, since:

$$r = \frac{\omega\ m}{\omega\ max - \omega\ min} = \frac{0.5\ \omega\ max}{\omega\ max} = ½$$

For engine sets used on aeroplanes, we can ignore the term r_v and determine the Steadiness Factor by formula (23), substituting for P_{mi} its value in function of ω drawn from formula (24).

The term r_v can only be of practical importance if we wish to determine the characteristics of an engine fitted with a Renard fan-brake, the determination to be made as fully as possible and at the various rates of gas intake. Under these conditions, and especially for low rates of rotation and at full intake, β becomes very large and r_v can no longer be ignored (see Formula 20).

Fig. 2 gives the values of r_h, r_c and r_v as function of ω and of C_{mi}* for a three-cylinder engine giving 30 H.P. at 1,200 r.p.m. (See Fig. 2.)

We have ignored the variation of the reduced mass, for the term $\frac{n}{2} \cdot N$ $(025\ M_b + M_p) = 0.7\%$ of the total reduced mass.

We have taken into account the constant term of the resisting engine torque.

The formulas employed for the Steadiness Factors are:

$$r_c = \frac{NI}{2} \frac{\omega^2}{a + bC_{mi}} \qquad (25)$$

$$r_v = \frac{2\,C_{mi}}{a + bC_{mi}} \qquad (26)$$

$$r_h = \sqrt{r_c^2 + r_v^2}$$

On the surface $r_h = f\ (n, C_{mi})$ we have indicated the curve AB corresponding to the coefficient $r_h = ½$.*

Fig. 2 shows that it would be easier to obtain low speeds of rotation with a fan brake absorbing much power, and that in such a case the term r_v is of real importance in *increasing the Steadiness Factor.*

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* In this case it is more convenient to use C_{mi} than P_{mi}.

* The minimum speed of rotation would be zero on condition of employing a Renard fan-brake with infinitely large brake surfaces. This is evidently a practical impossibility; and besides, we are not well acquainted with the variation of the engine torque in very low speeds of rotation.

AIR MAIL MILEAGE

More than one and a half million miles flown by the planes in the Air Mail Service shows that 21 air mail planes have traveled more than the distance around the earth at the equator. The prize plane of these veterans of the air was D. H. Plane No. 76, which had 38,348 miles in 407 hours and 8 minutes before it went out of service in a bad crack on October 16, 1920. The average speed of this plane was 94.4 miles per hour. The plane with the next greatest record was D. H. Plane No. 74, which flew 38,381 miles in 420 hours and 15 minutes, and is still going strong across the Sierra Nevada Mountains from Reno to San Francisco. It is one of the planes that the air mail mechanics expect to see reach the ripe old record of 50,000 miles or better. Its average speed per hour was 89.1 through the entire period of its activities. This plane has added 3,443 miles to its record during the months of January and February. Four other De Haviland planes have each exceeded 30,000 miles of operation.

Next to these top-notchers in the mail service stand the two Curtiss R-4 planes. Of these, No. 31 had a record at the close of 1920 of 33,644 miles in 378 hours and 49 minutes in the air. This is an average speed of 88.8 miles per hour. The second Curtiss R-4 plane with better than 30,000 miles was No. 35, which covered 30,948 miles in 397 hours and 25 minutes in the air. This is an average speed of 77.9 miles per hour. Planes Nos. 31 and 35 are operating between New York and Washington to-day, and the former has an addition of 6,885 miles accumulated during the months of January and February.

The first aeroplanes used in the Air Mail Service on the date of its inauguration, May 15, 1918, were some Curtiss JN-4 training planes. The first day of the service was opened with planes Nos. 11 and 12 of this type. Both of these planes are in operation to-day between St. Louis and Chicago. No. 11 has covered 31,208 miles in 468 hours and 28 minutes of flying, an average speed of 66.7 miles per hour; and No. 12 has covered 30,090 miles in 447 hours and 25 minutes in the air, an average speed of 69.1 miles per hour.

The first planes purchased by the Post Office Department were 8 machines manufactured by the Standard Aircraft Corporation of Elizabeth, N. J., which was in business only during the war. Seven of these 8 planes are still in existence, two of them flying daily between Chicago and St. Louis. Their best record is 15,781 miles in 207 hours and 15 minutes, or an average of 76.3 miles per hour, for one plane; and 10,256 miles in 141 hours and 29 minutes, or an average of 72.4 miles per hour, for the other plane.

Two of the Glenn L. Martin twin-motor planes put into service in the winter of 1919 have exceeded 25,000 miles of service. Plane No. 201 of this type has run 27,757 miles in 363 hours and 46 minutes, an average of 75.3 miles per hour. Plane No. 202 has seen 25,593 miles of service in 287 hours and 18 minutes in the air, an average speed of 89.2 miles per hour. Both of these two planes are being repaired and overhauled and give promise of getting into the 40,000 to 50,000 miles class.

The Junker all-metal monoplanes are the latest planes put into the Air Mail Service. They have not had the mileage that should have been obtained from them, owing to the fact that these planes had serious engineering defects in their fuel system and engine installations. One of these planes has covered 7,677 miles between August and December 31st in 94 hours and 41 minutes, an average of 81.1 miles per hour. A second of the all-metal monoplanes has run 6,159 miles in 87 hours and 49 minutes, an average of 70.5 miles per hour. Both of these planes have additional mileage accumulated during January and February.

Up to December 31, 1920, the planes in the Air Mail Service have been in the air 18,806 hours and 37 minutes and have covered 1,572,450½ miles. This is an average for all types of planes under all conditions of operation of 83.6 miles per hour. In that period they have carried more than 49,000,000 letters. The mechanics' time and the cost of plane and repair parts over this entire period of service have been at the rate of 30.5 cents per mile flown.

In announcing this performance of the air mail planes, the Post Office Department make its acknowledgment to the mechanics who are charged with repairing the planes and keeping them in condition for the daily flights with the mail, and to the pilots who have handled them with daring and judgment under most trying and adverse conditions of weather. It is a performance far beyond the conception of the most optimistic authorities in aviation.

Are Present Types of Airships a Commercial Proposition?

A very frank and illuminating article on the commercial possibilities of present-day airships appear in this journal. The writer discusses the subject from a strictly business and severely practical point of view, and his conclusions by no means coincide with the opinions hitherto expressed by airship enthusiasts in England and Germany.

After dealing with the early history and gradual evolution of our latest rigid airships, the following pertinent questions are asked. "Is a regular service possible with the existing types of airships? What are the reasons for an unconditional negation? Why are the true facts hushed up?" The writer's personal views on these questions are fully dealt with and he concludes that "with the present-day airships the solution of a world aerial service will never be attained. An entirely new type of airship will require to be evolved. As long as the navigation of an airship requires the discharge of ballast to compensate atmospheric variations of temperature, a long distance airship service will remain an absurdity. Most of the distastes to airships are—next to the destruction by fire—attributable to this cause.

"For an economic trans-ocean service, the ability to ascend to 7,000 or 10,000 feet must be absolutely ensured. In such a case the nicely calculated figures of useful load disappear, because for physical reasons the lift of an airship at an altitude of 10,000 feet is about two-thirds of the lift near the ground. A Zeppelin-type airship with a gross lift of say 60 tons and a calculated useful load of 15 tons (150 passengers) will lose at a height of 10,000 feet approximately 18 tons of lift, so that the carriage of passengers is only possible on paper. The reason for the low altitude of the Bodensee's flight (1,000 feet) thus become immediately apparent."—(*La Gazette de Hollande,* 19 January, 1921.)

FOREIGN TECHNICAL DIGEST

Navigation By Compass

This article deals comprehensively with the subject of navigation by compass and gives a number of problems encountered in aerial navigation and their solution. The subject of deviation and compensation is well covered by actual flight instances and clearly illustrated by diagrams. (*Bulletin de la Navigation Aerienne,* January, 1921, 8½ pages, 22 diagrams.)

The Vickers Viking

We have received the following from Messrs. Vickers, Ltd:—

The building of the Viking was first discussed in December, 1918, and Viking Mark I. was flying in February ,1919.

The experience gained with this type was incorporated in Viking Mark II., which was launched at the end of that year.

After many improvements had been added to this machine, she was entered for the Antwerp Exhibition in July, 1920, and was classified as first in the following:—

(*a*) Shortest time in getting off the water.

(*b*) Fastest time over a given circuit.

(*c*) Shortest time in climbing to 1,000 metres.

(*d*) Highest "ceiling" or altitude with full load.

This competition was an international one, open to all types of seaplanes and flying boats, so that the success of the Viking was particularly creditable and a noteworthy triumph of the amphibian over other types.

The development of this type of aircraft was considered so vital by the Air Ministry that early in 1920 a prize of £10,000 was offered by them for the most efficient type of amphibian produced in the British Isles.

In this competition, which took place in September, 1920, the first prize of £10,000 was won by the Viking Mark III., and it was won under such exacting conditions that only an exceptionally well designed and constructed machine could have withstood the tests.

It is a most remarkable fact that the amphibian class was the only one in which the full award was granted.

The advantages of this type are many, far more than is usually supposed, seeing that all the special features of the aeroplane and flying boat are combined in it. In island countries or in those places not wholly surrounded by water this type is unsurpassed. In districts watered by large or small rivers the Viking is unrivalled, and a vast amount can be saved in the laying out of aerodromes when water will answer the purpose equally well.

The use of this machine is essential in countries where the seas or rivers intervene between places where air traffic is necessary.

The flying boat is unable to make a direct flight over continents, the land machine cannot undertake journeys over water without running great risks, so that the amphibian alone is capable of flying by the most direct route regardless of what lies below it.

It can, owing to its performance and manœuvrability, get off from or alight on a seaplane carrier.

The ordinary flying boat is unsuitable for use on seaplane carriers, seeing that it cannot alight on the ship's deck or arise from it.

The amphibian can, if necessary, alight on the water beside a ship and be hoisted on board.

Its wings are made to fold by a novel methods, so economizing space. The arrangements for folding the wings of the Viking have not up to the present been used on any other type. The wings fold forward so that in flying the strain tends to keep them in position. When folded the Viking Mark IV. occupies a space of 32 ft. by 35 ft.

It can be said that the life of the amphibian is at least ten times as long as that of her cousins, the seaplane and flying boat. A saving of personnel amounting to from twenty to fifty men can be effected by the adoption of this type and the discarding of existing machines. (*Aeronautics,* January 20, 1921, 1 page.)

The Commercial Fokker V. 1

This articles describes the Fokker V. 1 equipped with a 185 H.P. B.M.W. motor. It is a monoplane with internally braced wings and with the fuselage suspended from the aerofoil. It has a total span of 17.2 meters; length, 11.55 meters; a height of 3.67 meters, with a total cruising radius of 1100 kilometers. (*Aeroplanet,* November-December, 1920, 2 pages, 2 illustrations.)

The Zeppelin Airships, L64 and L71

Of the L53 type, to which L64 belongs, thirteen ships were built, and though these were not all identical, they may be regarded as of one design, with the exception of L57 and L61. The external dimensions are the same as in L49, and are as follows:—Length 642 ft., maximum diameter 78 ft. 6 in., and volume 1,950,000 cu. ft. The hull viewed cross sectionally forms a polygon of 25 sides. The arrangement of cars is also similar to that in L49, and consists of the control car forward, a pair of wing cars amidships and an after car. The gross lift is approximately 59 tons. The radical departure in the construction of the hull from the previous type lies in the introduction of 15-metre frame spaces throughout the ship, with the exception of four 10-metre spaces at the after end. This has the effect of reducing the number of gasbags from 18 to 14, and lightens considerably the whole of the hull structure. In the 15-metre frame spaces are introduced two intermediate frames, a number which is reduced to one in the 10-metre spaces above mentioned. It will be seen, therefore, that throughout the ship transverse frames occur at 5-metre intervals. The construction of girders is the same as in the preceding type, with the exception that the joints are strengthened slightly. Five 250 h.p. Maybach engines supply the motive power.

L57 is the airship which gained notoriety during the war on account of her flight from Jamboli to East Africa and back carrying stores for the German forces under Von Lettow. This ship, having been designed to carry extra weight, two additional 15-metre frame spaces were introduced, which increased the parallel portion of the hull. Owing to this increased length structural weakness was observed, and the additional parallel section of hull afforded a consequent decrease in speed. L57 was, accordingly, accounted a failure, and the original design was continued in the later vessels.

L61 was the first ship to which the new streamline fins were fitted, and may be considered as the transition ship between the L53 and the L70 classes.

The L70 is the latest type of war-time Zeppelin, three models having been completed, and embraces the largest airships which have actually flown up to date. The chief departures from the L53 type are:—(1) Increase in length from 642 ft. to 743 ft.; (2) Increase in number of cars from four to six; (3) Introduction of streamline fins.

The increase in the length of the hull framework was effected by the introduction of two additional parallel sections of 15 metres each, the bow and stern portions remaining as before. The result of this gives an increased number of gasbags, 16 as against 14, and a total volume of 2,420,000 cu. ft. Owing to the additional sections being parallel sided, a true streamline form was unfortunately lost, and a decrease in speed due to this cause is stated to be quite noticeable.

An innovation in this class are the internal bracing wires between each frame which pass through sleeves in the gasbags. These bracing wires were fitted to reduce the excessive vibration experienced when the ship was proceeding at full speed with the bags only half full after descending from great heights. The experiment proved very successful, and was adopted in the ships of the earlier class as they came in for periodical refits. The internal corridor is also strengthened, and at the after end assumes a V-shape instead of the inverted V, to give a greater volume to the two after gas chambers.

The introduction of the streamline fin marks a radical departure in airship design. By this method the mass of external bracing wires is reduced to the barest minimum. Only three external wires are now required, one connecting the four outer pintle bearings, the other two being attached to the outer pintle bearing of each fin and carried to two points on the hull framework. All the fins are of the same external shape, and speed trials carried out with L65, the first ship to be fitted with these fins, gave an increase of approximately 2 miles per hour.

The design of the *Bodensee* has shown that the Zeppelin Company is aware that perfection was not attained with the L70 class, a fact which airship designers and constructors in this country will do well to bear in mind. (*Aeronautics,* January 6, 1921, 1 page.)

Aerial Ambulance

Amongst the numerous schemes to which aircraft can be utilized, not the least interesting is its usefulness in aiding the beneficial work of the medical practitioner. During the war the aerial ambulance demonstrated its possibilities and in France the scheme is now being turned to "peace-time" use. Two machines have been constructed; one a *Breguet* biplane, type XIV, fitted as an ambulance capable of carrying two patients, and the other a *Voisin* biplane, type X, reconstructed to carry the appliances necessary for surgical work. In this article a complete description is given of each machine, with their respective spheres of usefulness—more especially in the colonies where road transport is generally slow, and the factor of "time" of great importance. (*La Conquete de L'air,* Feb. 1, 1921).

NAVAL *and* MILITARY AERONAUTICS

Admiral Sims Favors Aircraft Carriers

Belief that aircraft carriers would displace battleships as the capital fighting ships of the future was expressed by Admiral William S. Sims in a speech at the National Republican Club. Admiral Sims qualified his opinion slightly by saying that this would be true if the aeroplane would do what its advocates claimed for it, but added that this would be sufficient, without regard to what might be developed in the aeroplane of the future.

Admiral Sims described the aircraft carrier as a ship which would carry eighty planes and have a speed of thirty-five knots an hour, sufficient to outpace the swiftest battleship.

"The aircraft carrier is a battleship that can fire upon the enemy at a range of 100 miles," he said, explaining that swift planes could leave the ship at a speed of from 90 to 150 miles an hour and drop bombs or shoot torpedoes at the slower battleships.

The aeroplane officers said they could carry torpedoes weighing 1,600 pounds or bombs weighing 1,000 pounds each and obtain a fair percentage of hits on a single battleship and a greater percentage on a fleet. He also said the aeroplane experts expected to make effective use of gas bombs dropped from heights of from 5,000 to 10,000 feet.

Admiral Sims then described a battle between two fleets, one of sixteen battleships and four aircraft carriers and the other of twenty aircraft carriers, each with an equal complement of auxiliary ships.

"The aeroplanes of the battleship fleet would be swept out of the air," he said. "The only defense the battleship fleet would have then, as it would be unable to close with the swifter aircraft carriers, would be through anti-aircraft guns. I have had some knowledge of gunnery, and accurate gunnery is possible only when the target is in the same plane. The percentage of hits by anti-aircraft guns on the western front during the war was less than one out of a thousand."

Admiral Sims said the naval officer was naturally conservative and that it was a matter of record that the majority of naval opinion had opposed innovations. As an illustration, he said that practically all naval officers, German as well as British and American, underestimated the possibilities of the submarine before the war demonstrated what the undersea craft could do.

Any new weapon that comes up is bound to be misunderstood.

Chief of Air Service Visits March Field

Major General Charles T. Menoher, Chief of Air Service, arrived at March Field on his inspection tour of all Air Service stations in the Ninth Corps Area. He was accompanied by Major John W. Simonds, assistant administrative officer, and Major H. H. Arnold, corps area Air Service Chief with headquarters in San Francisco.

General Menoher made a detailed inspection of the various flights and hangars. Ships were all "on the line" and the personnel of each flight in proper place. Following his tour of the line General Menoher visited various departments on the field and spent considerable time in the Service Men's Club. The Post band gave a short concert and later the general addressed the officers of the command at the Officers' Club.

Following a brief reception and luncheon at the Mission Inn, General Menoher and his staff left via motor car for Ross Field and Los Angeles. It is reported that he was very well pleased with conditions at March Field.

428 Flights at March Field During Week

Fifty-two planes at this field made a total of 428 flights during the past week. Approximately 15,930 miles were flown in a total of 242 hours 10 minutes. Preliminary instruction required 158 hours; advance instruction, 37 hours 15 minutes; test flights, 7 hours 20 minutes; and miscellaneous flights, 39 hours 35 minutes.

Scholarship in Radio-Aeronautics

Unusual honors have come to Harold W. Setley, Electrician First Class (Radio, Aviation), who has been awarded the gold medal as honor man in the recently graduated class in Radio-Aeronautics at the Aviation Mechanics' School, Great Lakes Naval Training Station, Ill. The class started September 1, 1920, and ended January 29, 1921, Setley graduating at the head of the 37 students to finish. He is now on duty at the radio and telegraph office of this station, under Lieut. E. S. Walling.

The course at the school included advanced mathematics, heavier-than-air theory, wire room for making terminal inspection, fabric covering for panels and repairs of panels, lighter-than-air theory, inspection and assembly of lighter-than-air equipment, seamanship and propellers.

During the entire course Setley had but three marks lower than 4.0, the highest possible mark. He was complimented by Captain J. H. Tomb, and also by Lieut. Commander Wilson, of the Aviation Mechanics' School, because of his high standing.

Aviation Facilities Near Puget Sound

The only establishment in the Thirteenth Naval District equipped for and competent to make extensive repairs to aircraft is the Boeing Airplane Co., Seattle, Wash. The J. W. Miller Aircraft Co., Green Lake Boulevard, Seattle, Wash., has a small shop and makes minor repairs on aircraft. Gasoline can, of course, be obtained almost anywhere between the Cascade and the Olympic Mountains. Oil suitable for aircraft is harder to get.

Seaplanes can land anywhere in Puget Sound, Lake Washington, Gray's Harbor, Lake Keechelus, Willapa Harbor, and the Columbia River.

For land planes, the parade ground at Camp Lewis is excellent. Spokane has two excellent fields. King County, Wash., has bought and is improving 219 acres at Sandy Point on Lake Washington.

Radio-Controlled Aeroplanes

The use of radio communication, both telegraph and telephone, on the military aeroplane, is perhaps the latest application of radio science, increasing tenfold the usefulness of the aeroplane and already influencing the design of military aircraft. Aeroplanes have been called the eyes of the army, but eyes without means of instantly communicating images and impressions registered upon the retina would find but a limited sphere of application. It is in the performance of this function that radio finds such an important place in military aeronautics. The dots and dashes of the Morse code transmitted from the trailing aerial of the aeroplane carry to the ears of the artillery battery commander the correction for each shot fired, enabling him to group his hits on an invisible target with a degree of accuracy as great as possible when the target can be seen, or bring to a waiting general news of enemy troop movements observed from the air.

Squadrons of Attack Pursuit Planes can be maneuvered in flight by means of the wireless telephone from the aeroplane of the squadron commander or from the ground as easily as a company of infantry is handled. By the same means a machine engaged in aerial combat and outnumbered may call for assistance.

Bombing planes lost in the fog or darkness are directed unerringly to the home aerodrome by the radio direction finder, and aeroplanes without pilots, controlled entirely by radio, are already a reality.

The Air Service of the Army, realizing the importance of this newest phase of radio, has established a school for the training of personnel to install, operate and maintain the radio equipment of aeroplanes at all of the flying fields throughout the country. Radio engineers and operators, as well as experienced amateurs, may qualify for attendance at the school upon application to any Army recruiting officer or to the office of the Chief of Air Service, Washington, D. C.

Cross Country Flights at Kelly Field

The followng cross-country flights were made in DH4B's on January 8, 1921: Lieutenant M. J. Plumb, as pilot and Lieutenant Godard, as passenger, went to McAllen, Texas; Cadet Tillery, as pilot, and E. Roberts, as passenger, to Del Rio, Laredo. Texas; Cadet McNown, as pilot, with Sergeant Hunter as passenger, Cadet Carrier, as pilot, and Sergeant Liefer as passenger, to Jourdanton, Texas; Cadet Snyder as pilot, and Sergeant Koskoski as passenger, to McAllen and Laredo, Texas.

Lieutenant S. F. Landers as pilot, and a sergeant as passenger. made a cross-country trip to Del Rio, Texas, on January 20, 1921, and returned the same day.

Personal Par

Captain W. I. Rasor has been assigned to Carlstrom Field.

FOREIGN NEWS

Edu Chaves' Long Distance Flight

The first successful long distance flight made in South America was completed on December 29, 1920, when Edu Chaves, the Brazilian civilian aviator, arrived at Buenos Aires, Argentina, at the conclusion of a flight from Rio de Janeiro, Brazil.

Chaves used for the flight a Curtiss-Oriole plane which was furnished him by the courtesy of the State Sao Paulo which formerly maintained a school of aviation.

The flight extended over a period of five days, the actual flying time being, approximately, 19 hours, with the following hops:

December 25, Saturday, from the Army aerodrome, Campos dos Affonsos, Rio de Janeiro, to the Campo de Guapira in the city of Sao Paulo, distance 400 kilometers, time elapsed, 2 hrs. 3 min.; December 26, from Sao Paulo to Guaratuba in the State of Parana, distance 450 kilometers, time elapsed, 2 hrs. 50 min.; December 27, from Guaratuba to Porto Alegre to Montevideo, Uruguay, time elapsed 6 hrs. 10 min.; December 29, from Montevideo to Buenos Aires, distance 220 kilometers, time elapsed, 3 hrs. 3 min.

German Frontier Aerial Navigation Rules

In order to obviate difficulties which have lately arisen on crossing the frontiers by air, and to simplify the control of aerial traffic, the German Embassy in London announces that the possession of the following documents is prescribed, pending final regulations to be issued at a later date:

1. Permit of the Imperial Ministry of Aerial and Mechanical Traffic for the pilot of the airship.
2. Permit of the Imperial Ministry for Aerial and Mechanical Traffic for the airship.
3. Certificate of the place of departure, showing clearly the airship's errand, the route of the flight, and particulars of the crew and cargo (passengers and goods).
4. Original or authenticated copy of a letter from the Imperial Ministry of Aerial and Mechanical Traffic, in which permission is given for crossing the frontier by air.
5. All the papers of identity for the passengers and cargo of the airship as are prescribed for crossing the frontier by land (passoprts, etc.)
6. Certificate of the Imperial Commissary for the grant of import and export licences.

In addition every airship must be examined by the competent customs officials, the last time it lands before crossing the frontier, as regards the carriage of articles liable to customs duty, etc. This examination is to be certified on the document mentioned under (3), or in a special certificate.

Germany Infringes Clauses Concerning Aircraft Disarmament

The following is the text of that portion of the official resumé of the Allied Governments' Conference held in Paris from January 14th to 29th, directly concerning aircraft disarmament and Germany's infringement of the Treaty of Versailles drawn up and signed by Great Britain, France, Italy, Belgium and Japan on January 29th, 1921:

I.—Germany has not surrendered all the aeroplanes, hydro-aeroplanes, motors, balloons, hangers (to be dismantled, destroyed, dispatched, or delivered out of the country), balloon accessories, wireless telegraph and photograph equipment, hydrogen, factories and reservoirs, machine-guns, and other aeronautical material (Artical 202). It may be noted with regard to the most imoprtant of this material there remain to be surrendered in accordance with certain estimates 1,400 aeroplanes and 5,000 engines.

II.—Since July 10th, 1920, Germany has recommenced aeronautical manufacture in spite of the decision taken by the Allied Governments at Boulogne on June 22nd, and she has attempted to export the material so manufactured in spite of the formal orders of the Commission of Control (Article 201).

III.—Germany has refused to furnish the compensation demanded by the Allies for the seven (7) Zeppelins destroyed in 1919 (Article 202).

IV.—Germany has not yet paid the sum of 25,000,000 marks still due as compensation for material improperly exported (Article 202).

V.—Germany claims to have the right to utilize aircraft in her police formations (Article 198).

VI.—The search for hidden material will be facilitated by the German Government, and the surrender, provided for by Article 202 shall be finished before May 15th, 1921.

VII.—Germany shall assure the execution of the decision of Boulogne, *i. e.*, no manufacture or import of aeronautical material shall take place until three months after the date on which the I. A. A. C. C. shall declare that Article 202 has been completely complied with.

VIII.—Germany must furnish the compensation demanded for the destruction of Zeppelins; the detail of such compensation will be fixed by a special contract.

IX.—Germany must pay the sum of 25,000,000 marks referred to above before March 31st, 1921.

X.—Germany shall conform to decision C.A.91-III of the Conference of Ambassadors dated November 8th, 1920, regarding the prohibition of the use of aircraft in police formations.

In addition, with a view to ensuring the application of Article 198 of the Treaty, forbidding Germany to possess any military or naval aviation, Germany shall accept the definitions established by the Allied Powers which shall distinguish civil aviation from military aviation forbidden by Article 198. The Allied Governments shall assure themselves by constant supervision that Germany is fulfilling this obligation.

Civil Aviation Subsidies in France

The French Government has adopted new regulations in regard to the granting of subsidies to aerial transport companies. In the past all machines actually engaged on aerial transport services received subsidies for every flight whether any load was carried or not. Under the new system the amount of subsidy for each machine will depend on the load carried. There is a vast difference in principle between the two methods. It will no longer be comparatively easy to maintain an aerial service unless efforts are also made to make that service useful.

British Manufacturers Receive Orders from the East

It is reported that Japan has recently placed substantial orders for British Flying Boats and aero engines. The Vickers works at Weybridge are also stated to be engaged fitting up a number of 504-K type "Avros" for the Chinese Government. It may be remembered that Vickers Ltd. received an order for 100 "Vickers-Vimys," some little time ago from the Chinese Government.

Italian Seaplane Tests

A number of Savoia S12 seaplanes specially ordered by the Italian Navy were recently officially tested at Sesto Calende, on Lake Maggiore. A speed of 222 kms. per hour and a climb of 4,000 metres were registered, the machines being fully loaded. The new Savoia S12 seaplane is fitted with one Ansaldo San Giorgio 600 engine. This machine is reported to have the greatest speed of any seaplane yet built.

French to Rebuild Forts, Not on Hills

The General Staff of the French Army has decided in the reconstruction of its frontier forts to place them all in valleys instead, as formerly, on the summits of hills. This radical change in all preconceived ideals of military fortifications has been made as the result of their experience in the late war.

Mooring Masts for Airships Being Tried

It is reported that experiments are shortly to be carried out at the Pulham aerodrome, England, with the object of establishing the stability of steel towers as moorings for big airships.

An attempt is to be made to moor the giant airship R-33, the sister dirigible to the transatlantic flyer, R-34, a steel tower 150 feet in height.

If the experiments are successful it will have a marked effect on the position of this class of aircraft as commerce carriers.

The steel tower here is an experimental one and not the highly developed tubular construction which the towers of the future are expected to be.

Goliath Makes Attempts for 100,000 Francs Prize

PARIS, Feb. 21.—The Grand Prix of the Aero Club of France, open to planes capable of carrying eight persons, opened last night with the departure of the Goliath, piloted by Ferdinand d'Or and Jean Benard from the aerodrome at Bourgen.

The huge plane started in the moonlight at about 10:30 o'clock on its 2,245 kilometer (nearly 1,400 miles) flight and at first everything went well. Before reaching Lille, however, the aviators ran into a fog, and lost their bearings. They returned to Bourgen, but will make another start this evening in their attempt to win the prize of 100,000 francs.

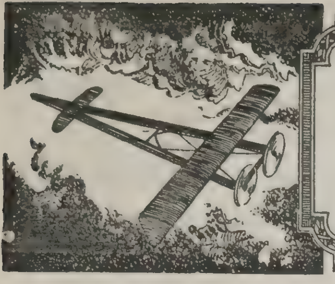
The Goliath is the only entrant at present, but flights for the prize may be made in either May or June on the 20th, 21st or 22d of either month.

A New German Aviation Company

The Handley Page Berlin correspondent states that the aviation company recently reported as in course of formation at Dantzic has now been registered there with a subscribed capital of two million marks under the title of the Internationale Luftschiffahrtsgesellschaft Ileg. The company takes over the existing premises at Dantzic used by the German military authorities during the war as an aeroplane factory and intends to build suitable flying machines for the new air services. It is said that sufficient aviation material is already available for the construction of at least thirty aeroplanes. The founders of the new venture are, a factory proprietor named Lilienthal, who is connected with the Albatrosgesellschaft, and a Dr. Donski, an engineer. The new company claims to have secured a contract from the Polish government for the conveyance of air mails between Dantzic-Warsaw-Cracow and regular services between Dantzic-Posen-Cracow have already been decided upon. Mails between Dantzic and Warsaw by the ordinary methods of transport take several days as compared with three hours by the aeroplane service now instituted. Dantzic-Lemberg is also included in the new program.

Belgian Colonial Aviation Progress

Thanks to the financial support of King Albert, who is himself an enthusiastic aviator, a flying mission left Belgium for the Congo Colony in October, 1919, and the first flight actually took place there in March, 1920. Since that date a regular service has been in existence between Kinshasa and Coquilhaville, in the vicinity of Gombe, at the junction of the Ubanghi. An extension from Gombe to Lisala will be inaugurated during this month on the arrival of the next steamer, and the service from Lisala to Stanleyville, a distance of about 380 miles, will be working before the end of this spring. Hydroplanes are being employed, the course of the Congo being followed as far as is possible. Up to recently, Stanleyville was entirely dependent upon the small river boats on the Congo for its mail services, the upward voyage taking 20 days, the return occupying 15 days. When flying regularly it is estimated that hydroplanes will not exceed three days on the trip. Up to the present to send a letter and get a reply from the Congo has usually meant a delay of three or four months. When the aerial mails are completed senders will be able to obtain replies on the return of the mail steamer which has carried the original letters. Great importance is attached to the development of aviation in the Congo and the Société Forminière, which exploits the diamond mines in the Kasaj at Djoko-Punda, is preparing to establish an air service between Kinshasa and their works. The line will cover a distance of 500 miles in two days as compared with the 35 to 40 days at present required to get to the mines. A hydrographic map of the river Congo has also been decided upon, and it is hoped to complete the work by hydroplane in about three years' time, as against ten to fifteen years in the ordinary way.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

Why "Pusher" Type Model Aeroplanes Are More Prevalent Than Tractors

WHILE there are numerous advocates of tractor model aeroplanes, those who favor the pusher types are in a position to cite several advantages of the latter, which make its choice desirable. There are also a great many model builders who design pusher types knowing that they can expect better flying results from them and yet make their selection from former customary practice rather than upon a scientific basis. In spite of the enthusiasm with which successful tractor builders regard their machines, it is possible to explain some of the conditions to which the two types are subject during flight, proving that under similar circumstances, and using the same construction, it might have been possible for tractor builders to attain even better results if the pusher type were employed.

Let us consider in this discussion that the machines are identical except for the location of the wings relative to the propellers and not considering variations in the incidence angle of the wings. In the first place, it is well to understand how a model aeroplane differs from the full-sized machine in flight and to realize that because the full-sized tractor aeroplane is at present the most popular type, it by no means follows that this type is most suitable for the model builder to copy. In a large aeroplane there is always present the human element which cannot, of course, be taken into consideration in model design. By moving his controls the pilot of an aeroplane can alter the flight path to suit his convenience and to counteract any contrary effect of the atmosphere. Models, on the other hand, once they are released for flight, are entirely at the mercy of the wind in which they fly, making their guidance and their attitude in the varying air strata a matter of mere chance.

The pusher model has a tendency to rise quickly in starting its flight and to assume a correct gliding angle when its power has been expended. The tractor type, on the other hand, takes a considerable longer run to get off the ground and when its power is expended is more apt to spiral down in a dangerous fashion. This does not mean that all tractors do this, but the average quick-rising tractor is greatly overpowered at the start of the flight and it is reasonable to expect an unnatural gliding angle at the termination of flight.

In setting the wings for a pusher type, the usual practice is to incline the front small wing at a slight angle of incidence and to have the rear, or main plane, set against the frame of the machine with no incidence whatever. In starting off under full power the effect of this setting is to lift the front end of the machine upward because of the greater relative lift of the front small plane at high speed. As the power is decreased (assuming in all cases that the usual rubber strand motive power is used) the forward speed of the machine decreases also with the effect that the front plane, which had such efficient lift to begin with, loses considerable of its lifting power and the nose of the machine is automatically dropped while the machine takes its proper angle of glide. The tractor type can employ no small lifting tail to the rear of the main plane in this manner, for the tendency would be for the tail to rise and the machine would not get into the air at all. So the practice is to provide the tractor with a flat or non-lifting stabilizer which, in itself, has no lifting properties but which is used solely to maintain the main wing at its original incidence setting on the machine as it proceeds through the air. Under favorable conditions the entire maneuver of taking off must be accomplished by the lifting effect of the main wing, and it will be seen that a much greater distance must be traversed on the ground before sufficient lift can be obtained. If it were possible to provide the tractor machine with an automatic rear elevator, to keep the tail of the machine down in starting and which would flatten out when the desired altitude were reached, the run along the ground could be considerably lessened, but we are dealing only with the ordinary types of models seen to-day.

Since the model must be automatic in its movements, those who wish their models to resemble large machines in flight will get the best results from the pusher type with its small front wing rather than the tractor type, which, although resembling more closely in appearance a real aeroplane, is less apt to possess characteristics giving it inherent stability. There may be cases where the builder does not seek flights resembling the maneuvers of a large machine, and for such builders the adoption of the pusher type may not serve his purpose. Then, too, the differences in flying qualities of the two types are varied sufficiently to justify the experimentation with both types, so it must not be assumed that the tractor has no merit as a flying model.

As an instance of the tractor model's success, no better example is to be found than in the results of the Villard Cup Contest which was won by the Illinois Model Club; tractors built by this club are reported to have shown their superiority in a good many instances, proving that this type was capable of a good deal more development than the results of previous years had promised.

Another factor which assists the flight of a pusher model is that the propeller is aft of the wings, leaving undisturbed air for the wings to work in. The tractor, of course, sends a blast of air over the wings, not only with high velocity but also in a spiral direction, affecting the machine's stability around its longitudinal axis. The propeller of a tractor aeroplane is little more efficient than that used in a pusher, due to the location which permits it to rotate in undisturbed air, but the detrimental effect of the disturbed air flowing from the wings of a pusher affects the propeller so slightly that loss of efficiency on that account is almost negligible.

When it comes to a question of stability in flight, there is one element which reacts unfavorably toward the pusher and that is its unstable behavior in the wind. During flight various wind velocities are encountered which disturb the machine's equilibrium according to their intensity. In meeting headwinds the small plane of a pusher is immediately lifted, pointing the machine upward, causing the model to ascend at a greater angle. This constant shifting of the wind therefore causes the pusher type to rise and to level off again in response to the air currents through which it travels. When a tractor machine meets a wind its tendency is to rise gradually with it rather than to point quickly upward, and in slight breezes the effect on a tractor is rather to slow it up a little while it continues to maintain its level path of flight.

A New Method of Building Model Wings

In model work, accurate wings are nearly always difficult to make, and to get the proper curvature, strength with lightness, and neat appearance, is often a perplexing matter. Mr. M. C. Bishop, of Nova Scotia, recently devised an unusual method of building up wings which possesses considerable merit, and solves many of the problems involved as well as being easy to construct.

The construction is paneled balsa wood. Single ply 1/60" Spanish cedar veneer (or, when this is not procurable, red fibre) is used in connection with a balsa wing in the following manner:

First a balsa block is formed to the desired outline and wing curve, the grain running parallel to the front edge of the wing. Locate with pencil markings the positions of the ribs and spars, and at these places glue narrow strips of veneer on both sides of the wing. When the glue has dried and the board removed from the press it will be found that the wing has been greatly strengthened by the reinforcing strips, more noticeable at the trailing edge, where it was formerly prone to flexibility.

It is then possible to lighten the wing by carefully cutting away the balsa between ribs and spars, leaving only the leading and trailing edges. More strength could be obtained by cutting a shallow groove where the spars are located and gluing continuous spar strips in place and running the rib strips over them.

This form of wing permits the employment of a complicated outline, with raked tips, balanced ailerons and a scolloped effect at the trailing edge between the ribs. Control surfaces and cantilever type wings, where the depth of spar varies from the center to the tips, may easily be built by this method. For strut attachments, pieces of wood should be glued to the spars, for balsa will not hold screws or nails. The width of paneling, ribs and spars must be worked out by the builder in accordance to the strength required.

No Dallying!

All was rush and bustle in the studio when the new producer began to get busy.

Turning suddenly to the weary "star," who was resting after the last stunt, he cried:

"We'll begin on the next episode now. It ought to be a thriller. You're blown up into the air by an explosion, and an aeroplane rushes along and catches you."

"It does, does it?" exclaimed the actor. "But, look here. Supposing the aeroplane isn't there?"

But the film producer's thoughts were already far ahead.

"Oh, that's all right!" he snapped absent-mindedly. "In that case, just come down: don't wait for it!"

Careless Swain

His fellow-officers gathered round him when the news became public property, and extended congratulations.

"But," said one man, "I understand the girl you are engaged to is a twin; how do you tell the difference between her and her sister?"

"Well, it's a jolly nice family," said the lucky man, "and I don't bother very much."

Flying Police

"Yes, your wushup, I was on duty in Section XII when I saw the prisoner. He was driving his 'plane at a furious pace and flying on the wrong side of the cloud. Held up my hand to stop him, but he took no notice, and after nearly colliding with a nursemaid on her aerial pram, he crashed right into the doorway of the 'Aviators' Rest,' causing the same to rock and nearly break from her guys."—*Flight.*

"An aeroplane is being employed to help locate shoals of fish for our fishing fleets."—*News Item.*

We expect that in retaliation flying-fish will be sent for from southern waters to keep the shoals informed of the movements of the fishing-fleets.

Reminiscences

Don't you remember those evening offensives,
  Just the odd five of you, strung in a V;
Old "Red-head" Murphy and Talbot and "Smithy,"
  Gordon (the Skipper) and you, Number Three?

Don't you remember your cheerful "Ack Emma,"
  Expertly swinging the prop with one hand?
"Vickers are loaded, sir; everything's ship-shape!
  Captain says take off exactly as planned."

Don't you remember, just over Armentières,
  Watching the skipper to catch the "high-sign?"
Signal to drop all your "eggs" on the station
  Or as the Hun's big dump came into line?

Don't you remember the peeps at your wrist-watch?
  (Joy-stick gripped hard between shivering knees)
"Half an hour more—and we're up twenty thousand—
  War *may* be hell, but I'm ready to freeze!"

Don't you remember the red-painted Fokkers
  Splitting around—and the sharp tac-a-tac?
Sometimes a Hun blazed a trail through the cloud-banks:
  Sometimes—a pal dived to earth on his back.

Don't you remember, too, just as the sun dip't,
  (Poised like a ball on the rim of the world)
Archie's finale—staccato—harsh—futile;
  Up through the gathering fog-blanket hurl'd.

Don't you remember, as darkness descended,
  Bumping your wheels on the old aerodrome?
Hearing the Major's quiet laugh and his welcome:
  "You're the last in, Son. Feel good to get home?"

The Little Minister

Sometime ago a pious young clerical prevailed on a rather profane aviator to take him for a flight. After attaining several thousand feet the motor suddenly stopped, revealing to the uttermost the aviator's gift of profanity.

The alarmed pastor excitedly demanded if there was any danger. The pilot replied sarcastically that there would be prayer instead of profanity if there was any danger.

The motor "cut in" again and the flight continued. Suddenly the motor stopped again and notwithstanding the pilot's efforts, accompanied by the usual lurid language, he was forced to alight. Just as he flattened out for his landing, the pilot was disconcerted by hearing the parson exclaim in fervid tones: "Thank God the aviator is still swearing."

Page the Hellicopter!

We are unable to give the nature of a jailbird's wings, but can state that its flying inclination exceeds its capacity.

"I'll wait until they invent sky-hooks before I start flying," grinned a cheerful idiot.

"Then you'll sure get hung on the skyline," grinned back our sarcastic mecano.

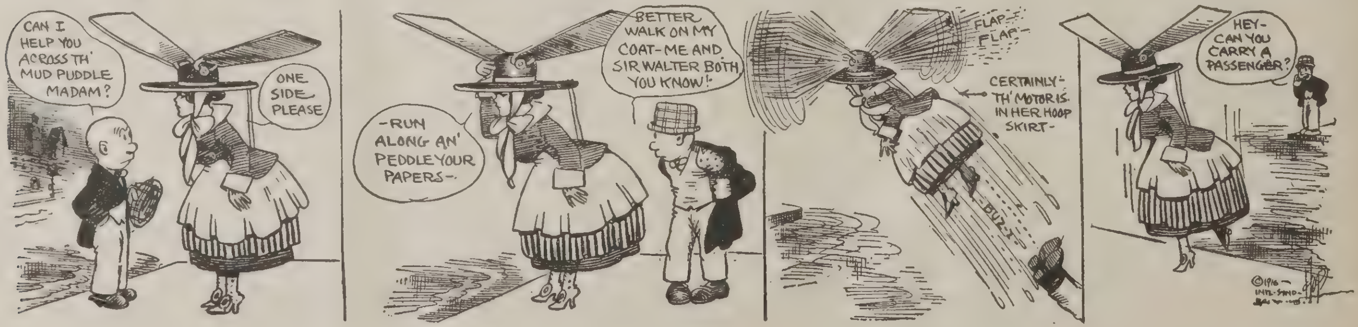
Longing

Why should I limit my wild dreams
  Of flight unfettered, mile on mile,
Till in Orion's starry dawn
  I shall alight and surely smile
At the small minds of earthbound serfs
  Who crawl and grovel in the soil,
And all our dreams of endless flight
  Strive hard to break with useless toil?

No, let me to the morning star
  Fly as to home and find my rest;
Nor shall its distance be to me
  A bar to limit travel's zest.
This is my universe to choose
  Where'er my soaring plane shall fly,
With every star a landing place
  And every road the ethereal sky.

Harold A. Danne.

SCOOP THE CUB REPORTER — **Some Sense to This Easter Bonnet** — **By "HOP"**


CAN I HELP YOU ACROSS TH' MUD PUDDLE MADAM?
ONE SIDE PLEASE
BETTER WALK ON MY COAT-ME AND SIR WALTER BOTH YOU KNOW!
-RUN ALONG AN' PEDDLE YOUR PAPERS-
FLAP-FLAP-
CERTAINLY-TH' MOTOR IS IN HER HOOP SKIRT-
BUZ-Z
HEY-CAN YOU CARRY A PASSENGER?
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AERONAUTIC BOOKS

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Aviation Chart

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(*Concluded from page* 658)

If his machine is very stable he may be able to put all control central and get back to normal in this way. In the meantime, however, he may have got the machine into positions involving stresses which are approaching the danger mark. Here the stabilizer would score heavily. If a pilot approaches a cloud he can set his elevator adjustment to what he wants, either a steady climb or horizontal flight, and so long as he keeps on his compass course by steering with the rudder, he has the satisfaction of knowing that the machine is proceeding normally. Again, for flying at night the stabilizer would be invaluable, as it would relieve the pilot of all control except that of steering.

In the case of twin-engine machines also the stabilizer appears to be of advantage. If one engine cuts out all the pilot has to do is to give opposite rudder. The device looks after the lateral control, and it also puts the nose of the machine down to compensate for the loss of speed. Considering all the assistance which the stabilizer can give to a pilot, and keeping in mind that more often than not machines are flying with less than their full paying load, it appears that for fairly large machines at any rate it is well worth fitting, while for night flying it will prove a great boon.

The Swiss Motor Muffler

Major H. S. Burwell proceeded to Deubendorf, Switzerland, on December 8, 1920, and spent three days witnessing the demonstration of an aeroplane motor muffler recently invented by a Mr. Berger of Zurich, Switzerland. He reported that he was very much surprised and interested to find that the invention was of considerable practical value and apparently did not heat up or diminish the power of the motor, while it reduced the volume of the staccato exhaust noises sufficiently to allow conversation between the pilot and the passenger. A lengthy technical report accompanied by blue-prints and photograph is being prepared for the Chief of Air Service.

Major Burwell described the fundamental principle of the apparatus as being quite simple, consisting only of a marked rapid cooling of the exhaust gases which action, as well as that of the expulsion of the burnt gases from both the manifold and the muffler, was assisted by a sharp suction created by small revolving blades and by centrifugal motion generated from either a connection on the cam shaft or from small exterior blades around the movable head of the stream lined muffler operating in the slip stream.

The appliance weights about 14 kilos, is one meter long, and 34 centimeters in diameter, and is made of thin sheet iron. The gases enter the tapered rear end of silencer into sleeves similar to an automobile muffler and are sucked and thrown out of the spinning head of front end, resultng in well over a 50 per cent reduction of noise, plus a blended and smoother sound hardly discernible from an altitude of 2,000 feet to a listener on the ground. This was tried when a Benz motor of 220 H.P. was being used.

The natural disadvantage is that of increased drag from wind resistance, which Major Burwell looked upon as objectionable, although the inventor claimed that the apparatus could be practically enclosed in an oval case, placed close to the top or bottom of the motor. Official recommendations are being made to the Chief of Air Service, Washington, D. C., for the purchase or construction of several types of this muffler for experimental purposes in order, possibly, to substantiate the inventor's claim that his present hand-made model is sufficiently perfected and efficient to permit an aeroplane in the future to: (a) carry on verbal instructions in the air between instructor and primary student; (b) make lower unexpected bombing raids possible; (c) allow the pilot and observer to work easily together and alleviate the difficulty of tuning wireless telephone sets over the noise of the motor; (e) allow plain code signals by use of the muffler cut-out to be sent from the plane to the ground; (f) make both military and civilian aviation more pleasant for the passenger and pilot; (g) reduce the exhaust blast so that the propeller noise is the predominating sound; and possibly even the claim that the muffler assists in keeping the spark plugs clean and aids in securing a purer gas mixture in the cylinders and therefore stronger power strokes.

Fight for Navy Air Station

Residents of the Rockaways have formed a Citizens' Committee to campaign against the proposal made by General George W. Wingate, in a letter to the Sinking Fund Commission, that the city oust the Rockaway Naval Air Station, so that the property may be used for park purposes. The Naval Air Station occupies a part of the Jacob A. Riis Park at Rockaway Point and General Wingate is opposed to the continued use of the property for this purpose.

Eugene L. Lezinsky, of Clarke Avenue, Far Rockaway, has been elected chairman of the Citizens' Committee. The other members are A. J. Kenny, head of the Rockaway Park Board of Trade, Rockaway Park; Dr. H. J. DeGroot, Rockaway Beach; H. I. Heyson, Far Rockaway, Jacob Leiberman, Edgemere and Arverne. The members of the committee were named by citizens in their respective communities.

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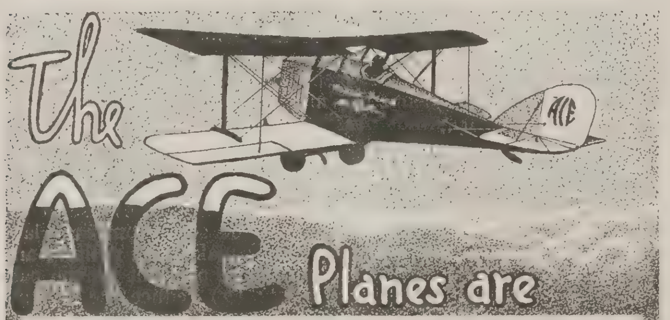

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VOL. XII, No. 26

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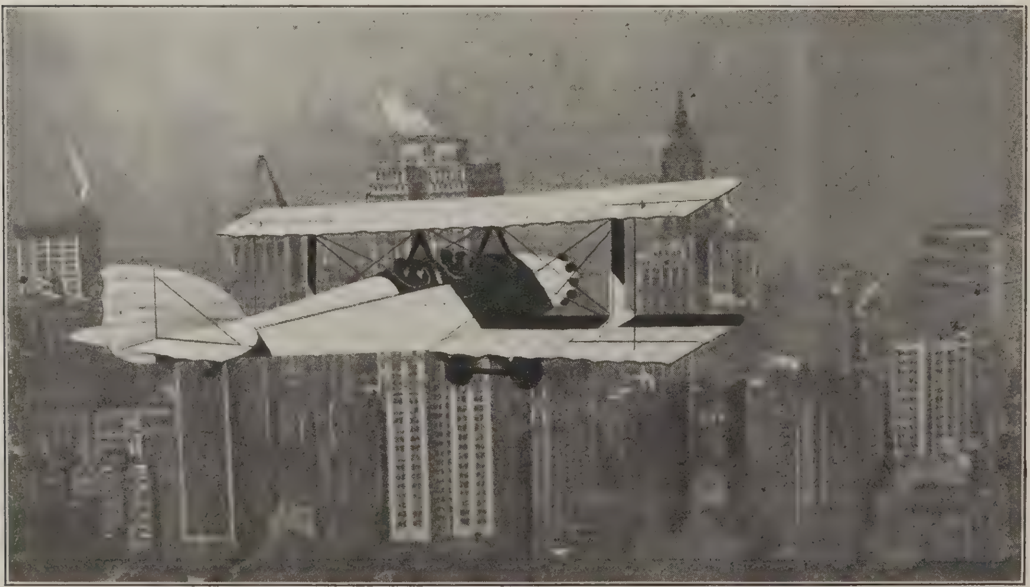

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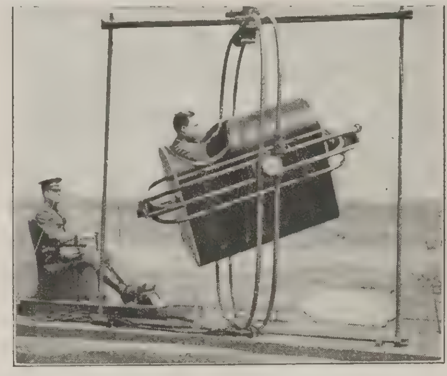

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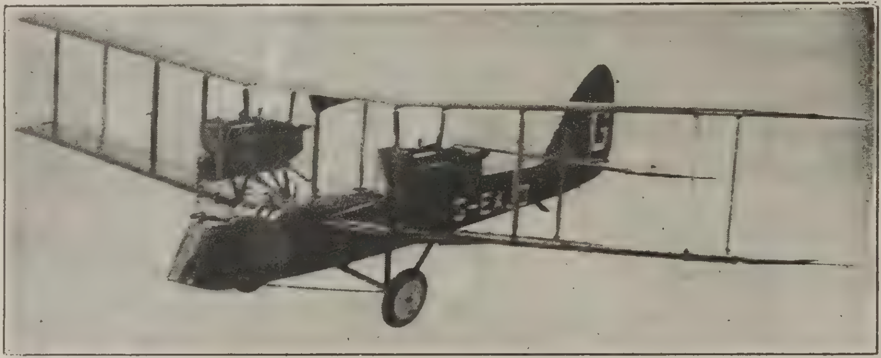

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